



Schweizerische Eidgenossenschaft  
Confédération suisse  
Confederazione Svizzera  
Confederaziun svizra  
  
Swiss Confederation

Federal Department of the Environment,  
Transport, Energy and Communications DETEC  
**Federal Office for the Environment FOEN**  
Hazard Prevention Division

September 2011

---

# Living with Natural Hazards

Objectives and priorities for action of the Federal Office for the Environment (FOEN) in dealing with natural hazards

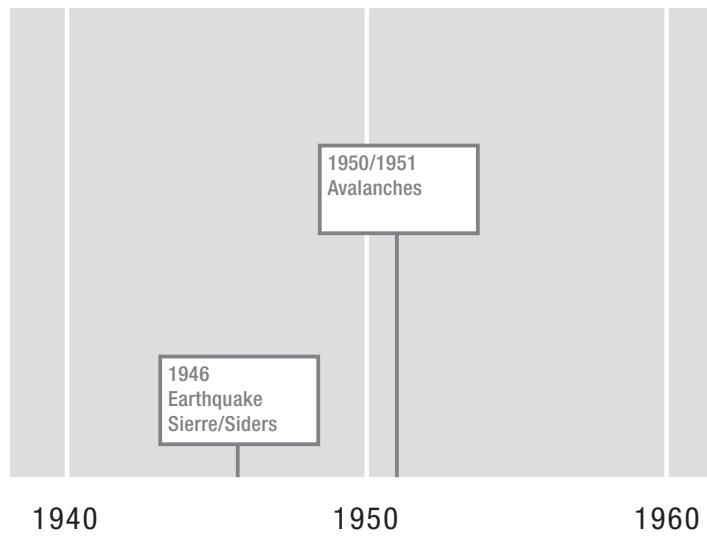
---



# Key hazard events

This document concerns the approach adopted to natural hazards, in particular **flood protection** (floods, bank erosion, debris flows), **avalanche protection, mass movements** (fall, slide and flow processes) and **earthquakes**, in Switzerland.

It does not cover the hazards arising from technological and industrial structures and plants or from accidents. However, given that major accidents can be triggered by the aforementioned natural hazards, it is important to note that interactions with these phenomena may arise.



## Imprint

### Published by

Federal Office for the Environment (FOEN)

### Compilation and collaboration

(FOEN, Hazard Prevention Division)

Hans Peter Willi (Head of Division)

Carolin Schärf (Scientific Officer)

Gian Reto Bezzola (Deputy Head of Division and Head of Risk Management Section)

Blaise Duvernay (Head of the Federal Coordination Centre for Earthquake Mitigation)

Olivier Overney (Head of Flood Protection Section)

Arthur Sandri (Head of the Landslides, Avalanches and Protective Forest Section)

### Design and production

Felix Frank Redaktion & Produktion, Bern

### Cover picture

Keystone/Alessandro della Valle  
(Werthenstein LU, 22 August 2005)

### PDF-download

[www.bafu.admin.ch/ud-1047-e](http://www.bafu.admin.ch/ud-1047-e)

(not available in print)

This publication is also available in German and French

© BAFU 2011

## Earthquakes

The first seismic hazard analyses and applications of seismic engineering arose in the context of the construction of dams and nuclear power plants in Switzerland in the 1960s.

However, building standards containing adequate modern seismic regulations for structures and plants were not published until 1989 in Switzerland. These standards were largely ignored initially and the implementation of earthquake-related **preventive measures** did not begin in Switzerland until the mid-1990s. The reason for this was the increased awareness triggered by the severe earthquakes that occurred in California (San Francisco 1989, Los Angeles 1994) and Japan (Kobe 1995).

Although Switzerland is a country with moderate earthquake activity and although the seismic hazard is classified as average, **strong earthquakes** can cause significantly greater damage than other natural hazards. The risk (probability × extent of damage) posed by earthquakes is comparable to that posed by flooding.

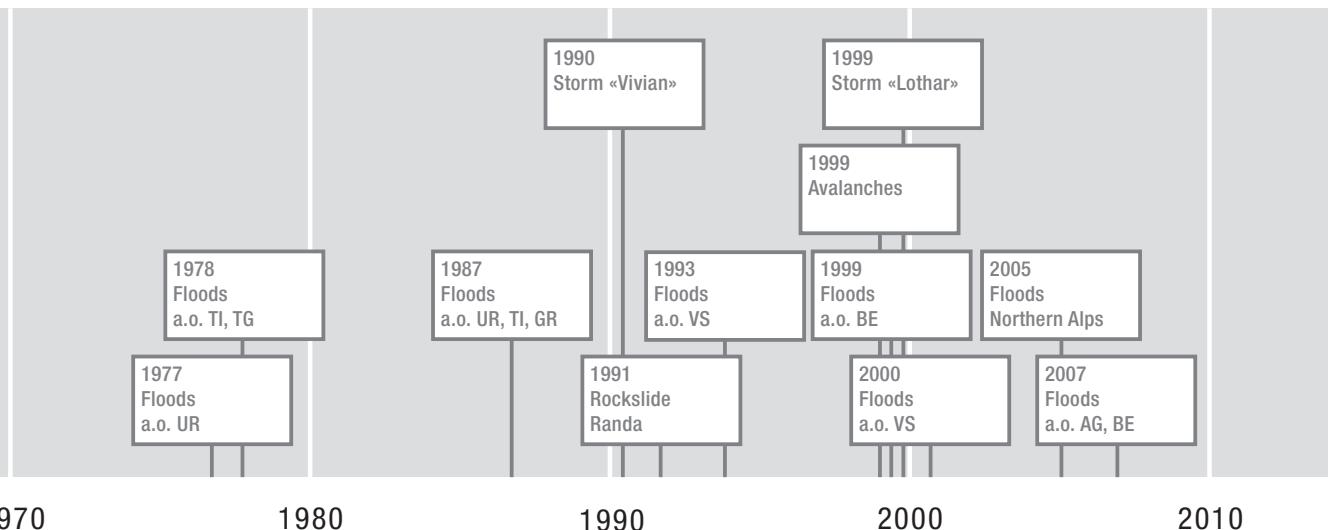
## Avalanches

The avalanche winter of 1950/1951 marked the birth of modern avalanche defence with the installation of industrially manufactured and standardized **barrier structures** in avalanche release areas.

A detailed event analysis (report on winter 1950/51) also laid the foundations for the targeted and continuous collection of meteorological data and information about the snow cover structure – and hence also the basis for today's **avalanche forecasts**.

At the same time, the realisation prevailed that adequate avalanche safety cannot be achieved through structural, biological (protective forest maintenance, afforestation) and organisational measures, but that **spatial planning instruments** are also required.

This led to the development of the first avalanche hazard map (Gadmen 1954, Wengen 1960), on the one hand, and the establishment of a crucial legislative basis at federal level in 1965, on the other. This law obliges the cantons to develop avalanche zone plans so that areas at risk from avalanches are not subject to further development.



### Forest maintenance

Up to the second world war, the high demand for wood ensured extensive forest management, including on **steep slopes**. Some protective forests were even overlogged. With the increased use of fossil fuels and alternative construction materials (concrete, plastic), forest management was gradually limited to more easily managed areas. As a result, the abandoned protective forests became increasingly dense and dark and the forests were not regenerated.

Changes unfold very slowly in forests, particularly in high-altitude mountain forests. Hence it took decades for the **negative impacts** of this development (loss of stability, tendency for large-scale forest collapse etc.) to become evident.

Protective forest maintenance was not defined as a public duty until the advent of the waldsterben (forest death) debate of the mid-1980s and has also been financed using federal subsidies since then.

### Mass movements

Because water is a crucial factor in triggering slope instability, the **water balance** plays a key role in the occurrence of mass movements. High precipitation intensities during extreme weather events caused a large number of slope instabilities and slope-type debris flows in recent years. Locations in geologically vulnerable areas dominated by flysch rock, molasse rock, slate or fine-grained slope debris are particularly prone to mass movements. Existing slope instabilities can be reactivated as a result of changes in the water balance (climate change).

**Climate change** has now become quantifiable and will also influence temperature and precipitation in Switzerland. The **disappearance of the glaciers** and **thawing of the permafrost** will also take effect – locally and in the long term – in the Alpine regions.

### Floods

By the aftermath of the storm events of 1987, at the latest, it became clear that structural measures alone are not sufficient to guarantee flood protection.

Since then **spatial planning** (master planning and land-use planning) has assumed far greater priority in the context of sustainable and natural-hazard-appropriate land use. The idea that **sufficient space** must be restored to water bodies and watercourses also became accepted.

Following further supraregional flood events in 1993, 1999, 2000, 2005 and 2007, it also became clear that Switzerland must expect **extreme major flood events** to arise in the future.

The most recent floods also showed, however, that damage can be reduced significantly with the help of **modern flood protection concepts**: robustly designed flood protection structures which are conceived to cope with excess loads are the key factors for successful prevention. Moreover, the damage caused by floods can be reduced by around one fifth if the authorities issue **warnings and alerts** in good time and people can take suitable measures to protect their property as part of their own individual responsibility.

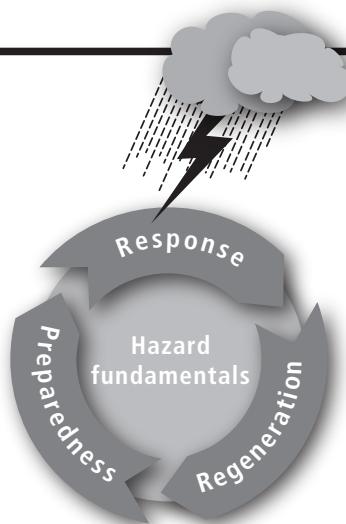
# Lessons from the past

A society can only deal sensibly with natural hazards if it has an in-depth knowledge of the hazards, assesses them objectively, takes preventive measures in good time and reacts quickly and correctly in the case of an emergency.

Various key hazard events (cf. above) and general awareness-raising in the area of the environment have contributed the development of a **holistic and sustainable basis** for natural hazard protection strategies in Switzerland. The aim is to achieve a level of safety is ecologically acceptable, economically viable and socially acceptable. There is no absolute protection against natural hazards, however. Hence **difficult questions** must not be ignored: What level of safety can be attained at what price? Which residual risks must be accepted?

Hence, dealing with the hazards of nature requires **integrative risk management** which combines structural, biological, planning and organisational measures along with insurance protection. The hazard potential can be primarily reduced using structural and biological measures. Spatial planning measures mainly diminish the damage potential and organisational measures lessen the extent of the damage. Robust hazard protection structures and emergency planning have a particularly important role to play.

The communes, cantons and federal authorities have made great efforts in past decades to protect the population, material assets and the natural basis of life against natural hazards. Despite this, damage – in particular flood damage – has increased significantly in the recent past. Protection against natural hazards is an **ongoing task** that involves not only the experts but also the general public.



## Integrative risk management

The experience gained in the past has culminated in the knowledge today that a holistic approach must be adopted to the management of floods, avalanches, mass movements and earthquakes: **preparedness, response and regeneration** are complementary processes and need to be coordinated more closely with each other. This requires comprehensive **hazard fundamentals** which are central to this cycle of risk.

Dealing with the remaining risks poses a key challenge for the years to come. We must assume that the number of extreme hazard events is likely to increase due to **climate change**. Hence, the adaptation of hazard protection measures to the altered and increased requirements arising from the possible effects of climate change constitutes a major challenge for all of society.

# The FOEN's objectives

---

It is the aim of the FOEN to provide and maintain a sustainable and consistent level of **safety** for human beings, buildings, infrastructure and other material assets throughout Switzerland within a period of 20 to 30 years. The overall aim of all measures is to reduce existing risks to an **acceptable level** and to prevent the emergence of unacceptable new risks.

The natural hazards objectives can only be achieved if agencies and authorities on all levels fulfil the **necessary tasks** together with those affected by the hazards in question. Protection against natural hazards is a **shared task**. The primary responsibility for protection against natural hazards lies with the communes and cantons. The Confederation fulfils its strategic leadership role and supports the cantons by providing finance and expertise.

This **division of tasks** must be clarified in cases in which it is not sufficiently established or in which deficits exist (for example in the involvement of insurance companies and property owners).

In addition to good cooperation, the necessary financial and human **resources** must be guaranteed on all levels. Careful financial planning by all participants and a harmonised legal framework (tasks and regulation of competencies) are crucial to the fulfilment of the stated objectives.

## Hazard information sources

Comprehensive information on all natural hazards throughout Switzerland is available, constantly updated and taken into account in all activities of relevance to natural hazards.

## Education and training

All staff involved in planning and emergency intervention and the population are educated in dealing with natural hazards and can fulfil their responsibilities accordingly.

## Protection concepts

Hazard protection concepts are planned on an integrative basis and based on robust and adaptive designs. Ongoing maintenance and periodic checks ensure the functionality of hazard protection structures. These are supplemented or upgraded as required.

## Earthquake mitigation

The requirements of the seismic standards are observed in the design of all buildings, plants and facilities. Where necessary, existing infrastructure and buildings are upgraded in relation to their seismic safety. The financing of damage rehabilitation caused by extreme earthquake events is regulated.

## Emergency planning

Up-to-date emergency planning exists in all areas and emergency operations are rehearsed regularly. Avoidable damage is prevented through timely warning and alerting and the provision of information in the case of a hazard event.

## Monitoring

Dangerous processes are identified in good time through the permanent monitoring of natural hazard processes and improved weather and discharge forecasts.

# Priorities for action

---

The following priorities for action for the federal authorities have been identified on the basis of the aforementioned objectives and derived from a comprehensive analysis of the associated tasks:

## Comprehensive knowledge of hazards and risks

Hazard-appropriate behaviour and spatial planning that is adapted to the prevailing hazard situation can only be guaranteed if the possible hazards and risks are known. For this reason, together with the cantons and communes, the federal authorities are doing everything in their power to produce the corresponding **information sources** by 2011 and update them regularly.

What is important here is that data about the natural hazards under consideration are recorded in a comparable form. All of the **measures** to be implemented build on these information sources:

- Spatial planning (structure and land-use planning, building regulations)
- Maintenance of existing protective structures and verification of their functionality
- Planning of new hazard protection structures
- Protection of property (permanent or temporary)
- Protective forest maintenance
- Emergency planning (including warning and alerting)
- Financial planning, calculation of financial risks

The **cantons and communes** are responsible for the compilation of hazard maps and the latter are also responsible for communal land-use planning (local planning).

The **Confederation** defines the legal framework and provides support for the work in the form of finance and consultancy (operating and implementation guides).

The various **stakeholders** require the most comprehensive information possible to enable them to fulfil their tasks. For example, insurance companies can only recommend measures for the minimisation of damage and risk if they have access to this information.

\*

Existing **gaps** in the hazard information sources should be filled as quickly as possible (for example in the areas of permafrost, slope instabilities, slope water/surface drainage, groundwater springs, sewage backup and in the area of earthquake mitigation).

## Increased awareness of natural hazards

The events of recent years have shown that the **population** is not very familiar with natural hazards. However, it is important to conserve and promote the knowledge that already exists on dealing with natural hazards and to document and analyse new hazard events so that lessons can be learned from them. The population should be informed in a targeted way and on all levels about the relevant natural hazards. This process starts at primary school level through the setting of corresponding learning goals for geography classes. These conditions are essential to enable the establishment of a **risk dialogue**.

Good hazard **event documentation** and other easily accessible information should ensure that the population does not forget existing hazards and assumes greater **personal responsibility** for hazard mitigation. This necessitates the provision of solid basic training in natural hazards for all those involved in the planning and construction of buildings, facilities and infrastructure as knowledge about the vulnerability of buildings is crucial to the minimisation of damage.

\*

**Research and development** in the field of natural hazards is also a component of natural hazard knowledge management. Application-oriented research and development should enable further improvements to be made in natural hazard management. In particular, the taking into account of environmental issues and climate change poses new challenges in the context of research and practice. Sustainable concepts are needed that leave future action options open.

\*

Finally, **international cooperation** is also very important so that the cross-border causes and consequences of natural hazards can be jointly managed by the countries involved.

## Holistic planning of measures

The implementation of integrative risk management should be combined with proportional land-use restrictions. Both **possible and likely developments** must be taken into account here (measures must be adaptable to changing hazard situations – for example through climate change).

The successful implementation of integrative risk management coordinates the action priorities: protective structures alone cannot guarantee safety. The necessary instruments must be developed and used to facilitate the comparison of action options.

Subsidy projects must fulfil current project requirements and present a good **cost-benefit ratio** to be financed by the Confederation.

\*

The commune of **Pontresina** provides a good example of the holistic planning of measures. In the late 1990s, the commune faced the decision about adding new stages to the existing avalanche barriers in the avalanche release area to attain the desired reduction in the avalanche risk. Investigations revealed that gradually thawing permafrost lenses were located in the avalanche release area. This meant that possible debris flow problems would arise in the future. Hence, instead of extending the traditional avalanche barriers, in 2001 a retention dam was built above the village which provides protection against both avalanches and landslides.

## Protective structures designed to accommodate excess loads

Protective structures must not collapse and fail and cause the sudden uncontrolled proliferation of damage when exposed to extreme volumes of runoff, bed load or physical stress. **Old protective structures** often fail to fulfil this requirement, however. Many protective structures which originate from the 19th century no longer fulfil the technical and ecological requirements applicable today. These include **important river engineering measures**, for example on the Rhone in the Rhone Valley, the Alpine Rhine, the Linth Canal, the Aare near Meiringen and the Hagneck Canal in the Bernese Lakeland.

Numerous **smaller structures**, which were constructed in the mid-20th century, also require renovation and upgrading to fulfil today's requirements. Their design is often based on experience gained at a time when extraordinary natural hazard events were comparatively rare and were not taken into account in planning as extreme events.

\*

The possible consequences of events that exceed the design capacity of the protective structures must, therefore, be known. The uncontrolled collapse of such systems can be prevented and the damage concentrated in areas with low damage potential (good example: river **Engelberger Aa** in the canton of Nidwalden) with the help of **accompanying measures** (monitoring, keeping drainage corridors free of buildings and providing deposition areas etc.).

\*

During the avalanche winter of 1999, avalanche barriers that were exposed to excess volumes of snow and physical loads were observed in 35 avalanche release areas. Despite this, there were no major avalanche releases from avalanche barriers and, at CHF 8 million, the damage caused to the structures was modest (< 1 % of the investment sum).

## Emergency preparedness

Careful emergency planning helps to reduce the damage caused by extreme natural hazard events. **Communes** must have an **emergency concept**, based on natural hazard information sources, and regularly rehearse the measures necessary for the successful management of such events. **Expert support** is provided by national and cantonal agencies (documentation and training). Since its reform in 2004, civil protection in Switzerland has been organised as a **civil network** involving the cooperation of five partner organisations: i.e. police, fire brigades, health system, technical operations and civil protection. They ensure that management, intervention, protection, rescue and assistance services are provided in the course of extraordinary situations. **Good cooperation** between experts, management and emergency personnel is crucial here. Overall responsibility lies with the **cantons**, however the main responsibility for emergency planning and organisation lies with the **communes**. In addition, the **federal authorities** may fulfil coordination or management tasks in the context of major hazard events in agreement with the cantons (Federal Act on Civil Protection and Civil Defence). The Federal Office for Civil Protection (FOCP) supports the cantons and partner organisations through its agencies (e.g. National Emergency Operations Centre) in the areas of planning and coordination of civil protection intervention and emergency planning. If the civil protection and defence resources prove insufficient, military resource may also be made available to the civil management bodies (subsidiary deployment of the army).

\*

The mobile flood protection barriers which were installed in the **Matte** (neighbourhood of Bern) after the flood of 2005 and prevented greater damage being caused during the flood of August 2007 are a good example of the holistic planning of measures. Due to the high degree of effectiveness of well prepared and timely intervention, the **improvement of forecasts, optimisation of warning and alerting and emergency planning** are priority topics at federal level.

## Timely identification of hazard events

Damage can only be limited if timely action can be taken at local level. This necessitates the perfect functioning of **forecasting and warning chains** and the interpretation of the available information at the end of this chain through on-site observations in the local context.

The necessary emergency measures must be implemented in good time on the basis of the information provided. This requires, first, the availability of **expert knowledge on sight** and central access to the available measurement data and forecasts.

**Training courses** for local natural hazard consultants are currently being developed by the federal authorities with the aim of providing the necessary expert knowledge to on-site management and intervention forces; this support is already provided by the avalanche services and will now be extended to the other types of natural hazards. Once developed, the training material is passed on to the cantons in accordance with the cascade principle. The latter recruit and train the natural hazard consultants together with the communes.

\*

It is also important to develop further the **Common Information Platform for Natural Hazards (GIN)**, on which the measurement data and forecasts produced by MeteoSwiss, the WSL Institute for Snow and Avalanche Research and the FOEN, are made accessible centrally to all natural hazard experts and to develop a public internet website on which the population can find relevant information about protection against natural hazards

\*

The networking of agencies which commenced with the establishment of the **Steering Committee Intervention against Natural Hazards (LAINAT)** and the **Specialist Natural Hazards Staff (Fachstab Naturgefahren)** at federal level should be enhanced and extended to all levels of the state.

The tasks to be carried out to attain the defined objectives are known. The most recent hazard events confirm the appropriateness and efficiency of the hazard protection strategy and show that the approach that has been adopted is the correct one. The task now is to ensure the consistent implementation of integrative risk management.

# Milestones at federal level

---

<b>1997</b>	<b>Establishment of PLANAT</b> The Federal Council passed a resolution on the establishment of an extra-parliamentary commission "National Platform for Natural Hazards" (PLANAT) in 1997. PLANAT advises the Federal Council on specialist questions and supports improvements in the approach to natural hazards at strategic level.
<b>2000</b>	<b>Federal Earthquake Preparedness Programme</b> The earthquake preparedness strategy developed by PLANAT was given concrete form in a programme of measures adopted in accordance with a resolution of the Federal Council of 11 December 2000. The programme aimed to ensure the systematic and consistent implementation of the necessary precautionary measures within the Confederation's area of responsibility and to efficiently promote the implementation of such measures at cantonal, communal and individual level. The Third Programme is currently under way (2009-2012).
<b>2005</b>	<b>PLANAT Strategy</b> The PLANAT strategy "Dealing with Natural Hazards in Switzerland" ("Umgang mit Naturgefahren in der Schweiz") was passed by the Federal Council in 2005. PLANAT aimed to provide the necessary basis for the implementation of the strategy by 2011. A follow-up action plan is currently under preparation.
<b>2006</b>	<b>New Federal Office for the Environment</b> On 30 August 2005, the Federal Council decided to merge the Swiss Agency for the Environment, Forests and Landscape (SAEFL) with parts of the Federal Office Federal Office for Water and Geology (FOWG) to form a new Federal Office for the Environment (FOEN). Hazard prevention was intensified as a result and the corresponding expertise assembled in one administrative body.
<b>2007</b>	<b>First Federal Council Resolution on the Optimisation of Warning and Alerting in the Event of Natural Hazards (OWARNA)</b> The experiences gained during the floods of 2005 resulted in the formulation of a plan for the improvement of warning and alerting (OWARNA), which is passed by the Federal Council in May 2007. The plan provided for the establishment of a Federal Reporting and Situation Centre (MLZ) within the National Emergency Operations Centre (NEOC) which would also record and disseminate information about natural hazards. Additional staff was appointed to the FOEN so that the production of hydrological forecasts, expert consultancy and situational assessments could be guaranteed round the clock in the case of a natural hazard event. Other measures included the creation of a Common Information Platform on Natural Hazards (GIN), the improved provision of information to the population, the further development of forecasting systems and methods and the guaranteeing of the emergency electricity supply. Another important aim of the entire project was the clear division of tasks between the national, cantonal and local bodies.
<b>2007</b>	<b>Parliamentary resolution on natural hazards</b> Based on the effects of the floods of 2005 and 2007, the Federal Parliament resolved that protection against natural hazards should be further intensified and increased financial and human resources made available for this purpose. These resources were to be used in particular for the response to the flood events of 2005 and 2007, the improvement of lake regulation and renovation of structures for protection against avalanches, landslides etc. and for protective forest maintenance. In addition, the Federal Council commissioned the Department of the Environment, Transport, Energy and Communications (DETEC) to develop a new finance model with the Federal Finance Administration to create a long-term basis for protection against natural hazards. New sources of finance require a constitutional basis on which investigations are being carried out (FIGEP project).
<b>2008</b>	<b>Introduction of the NFA</b> The new system of financial equalisation and division of tasks (NFA) between the Confederation and the cantons came into force on 1 January 2008. This involved a change in the system used to manage subvention policy and the simultaneous harmonisation of subvention rates in the area of natural hazards. Protection against natural hazards remains a joint task.
<b>2008</b>	<b>Parliamentary resolution on natural hazards</b> Despite the increase in credit provisions, it was not possible to cover all of the cantons' investment requirements in 2007. Based on two cantonal initiatives, Parliament increased the resources provided for protection against natural hazards for a second time in December 2008 to the current level of CHF 269 million. All of the important cantonal projects can now be subsidised using the resources provided under the finance plan.
<b>2008</b>	<b>LAINAT</b> The Steering Committee Intervention against Natural Hazards (LAINAT) was established to improve cooperation on natural hazard prevention at national level. All of the relevant federal agencies are represented on the committee, i.e. the Federal Office for the Environment (FOEN), Federal Office for Civil Protection (FOCP), Institute for Snow and Avalanche Research (WSL), and the Swiss Seismological Service (SED).
<b>2009</b>	<b>Federal Council resolution on the funding of the Third Rhone Correction (First Stage)</b> The entire stretch of the river Rhone from Gletsch to Lake Geneva, i.e. a 160-kilometre-long stretch, is being rehabilitated as part of the Third Rhone Correction. The extensive work involved should be finished over the next 25 to 30 years and the damage caused by extreme flood events should be reduced. The priority tasks concern the Valaisian sections of the river in Visp (building work has already begun here), Siders/Chippis, Sitten and the intercantonal section in the Chablais region. The investments for 2009 to 2014 total CHF 350 million and are being subsidised by the Confederation with a framework credit of CHF 169 million. Potential damage totalling around CHF 6 billion should be prevented as a result of the work being carried out.
<b>2010</b>	<b>Second Federal Resolution on the Optimisation of Warning and Alerting in the Event of Natural Hazards (OWARNA)</b> The additional resources are being used for the improvement of flood forecasting, in particular. Other tasks include the further development of the operation of GIN, the provision of information to the population and the training of local natural hazards consultants. In the case of a natural hazard event, the relevant federal agencies are mandated to establish Specialist Natural Hazards Staff (Fachstab Naturgefahren) for networking and to guarantee the availability of interdisciplinary expert assessments.