
Summary

On 26 December 1999 the extraordinarily violent hurricane Lothar hit Western Europe and Switzerland. It caused enormous damage above all in France, Germany and Switzerland. Since the damage was extensive and is expected to have long-term consequences for forests, the economy and society, the Swiss Agency for the Environment, Forests and Landscape (SAEFL) commissioned the Swiss Federal Institute for Forest, Snow and Landscape Research WSL to conduct, under the leadership of SAEFL and in collaboration with other partners, an analysis of hurricane Lothar in Switzerland. This report - which is now available - first of all divides the extent of damage in Switzerland into sectors and provides comprehensive documentation of the damage. Secondly, the report documents and analyses the wide range of measures taken by those involved and affected during the course of the hurricane as well as afterwards. The strengths and weaknesses of the individual actors in coping with the event became apparent as a result of the study. This analysis made it possible to make suggestions for improvement both in terms of prevention and response to similar events as well as recommendations for future action.

From a meteorological perspective, hurricane Lothar was an extraordinary event. What made it unusual was not so much its origin, which was driven by a central cyclone above the Atlantic and a strong zonal current from the Atlantic all the way past Central Europe. Much more surprising was the speed with which the secondary cyclone developed and the drop in pressure inside the hurricane, as well as the enormous maximum wind speeds on the ground, which were caused by the secondary low. The combination of the high forward speed of the pressure system and the high wind speeds due to big pressure differences also resulted in strong gustiness which, together with other factors, had a decisive impact on the damage caused by the hurricane. The trajectory of the central low crossed France and Southern Germany, while the top wind speeds and greatest damage, which was caused by the cold front that went with it, occurred in the southern sector of the hurricane, that is to say in Switzerland.

Hurricane Lothar traversed Switzerland within the space of some two and a half hours, from 10.00 to 12.30. In the process it crossed, coming from the canton of Jura, the Swiss Plateau, central Switzerland and north-eastern Switzerland in succession. The intraalpine region as well as south and south-west Switzerland were spared. The top wind speeds exceeded 140 km/h even in valley areas; in Délémont they reached 170 km/h and in Brienz even 181 km/h. In the mountains, top wind speeds reached 230 km/h on the Säntis and 249 km/h on the Jungfrauoch. In the Berner Oberland, the drop in pressure in advance of the passage of the cold front generated strong föhn winds with speeds as high as those of the hurricane itself, which increased the overall damage caused by the general meteorological conditions. The extremely high top wind speeds in the lowlands, which set records in many places, were particularly striking. On the other hand, the medium wind speeds were within the parameters to be expected for a strong hurricane.

A comparison with earlier hurricanes in Switzerland shows that although Lothar was an extremely strong event, it was well within the scope of what was to be expected. On average one hurricane with similarly high wind speeds sweeps across Switzerland once every thirteen years. Lothar is without a doubt among the most violent hurricanes of this type, but statistical analysis indicates that even more violent hurricanes cannot be excluded.

Based on the present state of knowledge a connection with the globally publicised climate change cannot be established; nor are there any signs of a trend towards an increasing number of extremely violent storm in Switzerland.

Extreme meteorological conditions were the principal reason for the enormous damage caused by hurricane Lothar in Switzerland. Fourteen people lost their lives during the hurricane and an additional fifteen during the forest clear-up work in the months that followed. The damage to forest amounts to 12.5 million m³ of timber, which corresponds to

three times the annual volume of trees felled and ca. 3 % of the timber stock for all of Switzerland. The total amount of damage to forests is estimated at more than CHF 750 million. Half of this sum is composed of shortfalls in proceeds from the collapse of timber prices, almost a third is composed of the loss of non-prepared timber, and the remainder are additional expenses for a more costly timber harvest in terms of time and money. With a tenfold increase in its annual harvest, the canton of Nidwalden was hit most severely, followed by the cantons of Fribourg, Bern, Obwalden and Lucerne. In agriculture, mainly tall fruit-trees were uprooted; of some 30,000 reported felled trees, a third were in the canton of Lucerne alone. In addition numerous trees were uprooted in parks and gardens. The amount of damages to individual trees and fruit-trees is estimated at more than CHF 38 million.

Besides damage to forests, the second largest damage caused by hurricane Lothar was to buildings and real estate. Damage to buildings in all of Switzerland is estimated at more than CHF 600 million and to movable property at CHF 125 million. In the canton of Bern alone, damage to buildings amounted to more than CHF 100 million; in the cantons of Vaud, Fribourg, Zurich, Aargau and Lucerne it was between CHF 40 and 60 million respectively. The cantons of Aargau, Fribourg and Basel-Landschaft also incurred high amounts of damage to buildings. However, relative to its size, the canton of Nidwalden suffered the greatest damage; more than 20% of all buildings in this canton were damaged.

Transport facilities were also seriously damaged by hurricane Lothar. Several hundred roads were blocked by toppled trees and several thousand vehicles were damaged. Municipal transport services were also affected by the hurricane, particularly in Basel, Zurich, Bern and Lucerne. According to conservative estimates the damage to street traffic (including vehicles) amounts to more than CHF 60 million. In railway traffic, SBB reported more than 80 lines cut off; an additional 56 were reported by private railway companies. The costs for clear-up and repair work amount to ca. CHF 14 million. In addition, transport firms incurred indirect damages which are difficult to quantify, such as the drops in sales due to breakdowns in lines, etc., or additional expenditure from the deployment of alternative service units. There was also damage to the transport infrastructure in shipping and docks on Swiss lakes as well as in Swiss airports, where infrastructure and aircraft suffered damage.

Hurricane Lothar also caused damage to cable cars and ski lifts. Besides direct damage estimated at ca. CHF 7.5 million, there was also serious indirect damage. Due to the high wind speeds before, particularly during and also after Lothar, many lift facilities had to be closed for several days. Since this happened between Christmas and New Year during the most important turnover period of the winter ski season, the sales losses were substantial. The loss of earnings for Switzerland as a whole were estimated at more than CHF 39 million. Telecommunications services and the Swiss electricity supply were seriously affected by hurricane Lothar, particularly where the top wind speeds coincided with an extensive above-ground mains network, as was the case in the outlying areas of large cantons. Disruptions occurred by trees falling on cables or pylons being snapped by the hurricane, as well as by destroyed relay and transformer stations. In remote valleys this caused long interruptions in electricity supply and the telephone network, as well as breakdowns of radio and television stations; the mobile phone network, on the other hand, was largely spared. The interruptions and power outages hit the cantons of Bern, Jura and Fribourg most severely. The damage from the repair the power lines alone is estimated at CHF 56 million.

Besides these direct kinds of damages caused by hurricane Lothar there were also indirect consequences and damages which are almost impossible to quantify. They include non-insured plant interruptions mainly caused by power failures, which affected computer systems, refrigeration plants, light, heating, etc., in equal measure. In the tourist industry, the main problem was not so much a reduced number of overnight stays but rather lower day tourism earnings in the winter sports sector.

Total quantifiable damage is estimated at ca. CHF 1780 million.

The measures taken by those affected to deal with the event were primarily aimed at determining the extent of damages and repairing the damages. In addition there are measures taken in advance to prevent and prepare for crisis situations, limit damages and make available crisis management resources, as well as meteorological storm warnings. All

these measures should be considered as a whole in order to arrive at a comprehensive description and evaluation of the measures taken to cope with hurricane Lothar.

As an institution charged by the Swiss government with the task of giving meteorological warnings, MeteoSwiss has an established infrastructure in order to issue comprehensive early storm warnings. Warnings are based on the continuous observation and analysis of weather developments. Switzerland is divided into different regions for the purpose of storm warnings. The warnings are addressed to the media as well as to the police and other interested persons. These structures were utilised in the case of hurricane Lothar. However, a precise forecast of this hurricane was extremely difficult, since even the large forecast models of international weather services initially overlooked the small disturbance above the Atlantic. Consequently, the strength and extent of the hurricane was only recognized on December 26, which resulted in shorter advance warning times in a number of instances. Moreover, presumably due to the holidays, in a number of places the addressees failed to recognise the importance of the warnings and thus to classify them and pass them on properly. As a result, in many places there was in effect no hurricane warning.

In Switzerland there are also numerous government organisations specialising in the management of crisis situations arising from natural phenomena. In general the principle of subsidiarity applies: crisis teams and task forces at the municipal level are the first to swing into action; only when the situation cannot be coped with at the local level does the canton or, as a last resort, the federal government intervene. The various cantons do have independent crisis management organisations adapted to their own laws, but they are all subject to the principle of subsidiarity. Due to the particular characteristics of hurricane Lothar, which was of very short duration and covered a wide area albeit without a catastrophic effect, in almost every affected region the crisis organisations capable of responding to the event at the municipal level were called in. Cantonal offices were only involved where the services are organised at the cantonal level from the outset, as is the case with the canton police. In many places special services were able to cope with the crisis themselves without having to call in the full crisis team.

Communication between the various special services and the crisis team responsible proved to be a critical crisis management factor in the local municipalities, as was informing the local population. Although such information channels are well established, power failures and damage to telecommunication networks meant that information could only be passed on to a limited extent. In addition, working telephone facilities were overloaded during the first few hours after the hurricane by a large number of calls for help, damage reports and inquiries from the population. What made the situation even more difficult initially was the fact that a flood of inquiries was received at a time when the hurricane warning had barely been registered; as a result many services were caught unprepared. Within the special services, the cantonal police were the first to be reached directly by the local population; the police also performed much of the co-ordination work to rescue those in distress, clear-up the damage and restore public order. The fire services carried out much of the securing and clearing up work; the main priority was to protect human life and provide first aid to those injured while clearing roads blocked by fallen trees.

In the forestry sector the forestry office and forest enterprises played the main role in dealing with the event. They took the first step to survey and estimate damage. After the necessary clearance and securing work was completed, which called for forestry competence even outside the forest, decisions and plans had to be made for preparing the forest timber for sale. The subsequent timber preparation is still under way and will continue into the year 2001. Besides the forest enterprises, cantonal and federal authorities were also active in crisis management. They made funds available and co-ordinated their use to deal with the serious damage to forests.

The insurance and electricity supply industries were also affected by hurricane Lothar and had to take measures to cope with it. Insurance companies received and had to process a flood of damage reports immediately following the hurricane. Power stations also had to answer a large number of queries from the population and had to organise fast repair work as well. In these two branches one of the critical factors adversely affecting contact with customers and their own work teams was the overloading of means of communication. The

procurement of additional manpower and material (in the case of power stations) proved to be difficult in parts.

In summary one can say that the high level of technical competence on the part of the persons and authorities involved in all areas was a decisive factor in the professional management of the crisis. Experienced teams, tried and tested operational sequences and a full use of personal contacts all proved to be of great benefit.

An assessment of the measures taken can be used as the basis for making recommendations for future events of hurricane Lothar's order of magnitude. Fundamentally, the response to the hurricane shows that Swiss society and economy are perfectly capable of coping with such an extraordinary event. Thus damage to hundreds of thousands of buildings – albeit very serious for individual owners – was for the most part repaired within a few months. The harm done to the Swiss economy was essentially limited to the first week after the hurricane. However, damage to forests was so serious that it will require continued plans and work for considerably more than a year.

Despite this positive overall assessment, a number of areas can be identified in which improved organisation, planning and deployment could result in better handling of a future natural phenomenon of hurricane Lothar's magnitude.

As for the meteorological warning system, an improved forecasting model was introduced in the summer of 2000 based the experience gained from hurricane Lothar. With respect to warning against such extreme events, whose impact is considerably more serious than that of ordinary storms, an analysis of channels and forms of communication is advisable, in particular to ensure that the authorities affected receive sufficiently early warning.

The response to hurricane Lothar in the forestry sector showed that if policy makers and government authorities make rapid decisions according to clear criteria this will have a decisive impact on the ability of those affected, particularly private forest owners, to carry out the necessary work in the forests. Here too the information and communication among those affected can be improved by means of new channels and clear structures.