International Forest Fire News (IFFN) No. 39 (January–June 2010), p. 74–79 ISSN 1029-0864 (web)

Swissfire: A Centralized Fire Database for Switzerland

Abstract

The Swiss Federal Institute for Forest, Snow and Landscape Research (WSL) and the Swiss Federal Office for the Environment (FOEN) cooperated on organizing a centralized forest fire database for Switzerland. The database allows the officers of the 26 cantons to enter and manage their fire data through a web interface. The system makes it possible to enter and manage not only the information on fire events and related parameters, but also additional fire relevant parameters such as meteorology, land-use and land-cover information, and population on different spatial (from municipal to national level) and temporal (daily to yearly) scales. This will improve the potential for analyzing the fire occurrence with respect to the driving factors. A second web application enables single operators to easily produce the periodic standard fire statistics on their own.

Introduction

Forest fire statistics are an important management tool for planning preventive technical (fire fighting facilities) and silvicultural activities and for optimizing fire-fighting strategies. In view of the ongoing climate change, it has become even more important to collect information on forest fires, even in regions where fires at present rarely occur. Only such a systematic approach will provide in the future the necessary data series to detect trends and changes in fire regimes in a consistent way. For this purpose the Swiss Federal Institute for Forest, Snow and Landscape Research and the Federal Office for the Environment FOEN started a joint project for implementing a centralized web-based national forest fire database – the *Swissfire* database in 2007.[1] This database is directly accessible to the cantonal forest services for data input, storage and analysis, including standard periodic reports.

Database design

The database has been designed in order to assure a very flexible handling of data (e.g. tracking the fusions of municipalities), as well as storing data on different spatial and temporal scales (from the municipal to the national level, from days to decades). For this purpose, a list of relevant fire parameters was chosen representing a reasonable balance between the required level of detail to be informative and the need to ensure that collecting and handling the data can be done easily by the foresters concerned. The database structure consists of seven main tables (Fig. 1 and Table 1) and around 30 auxiliary tables.

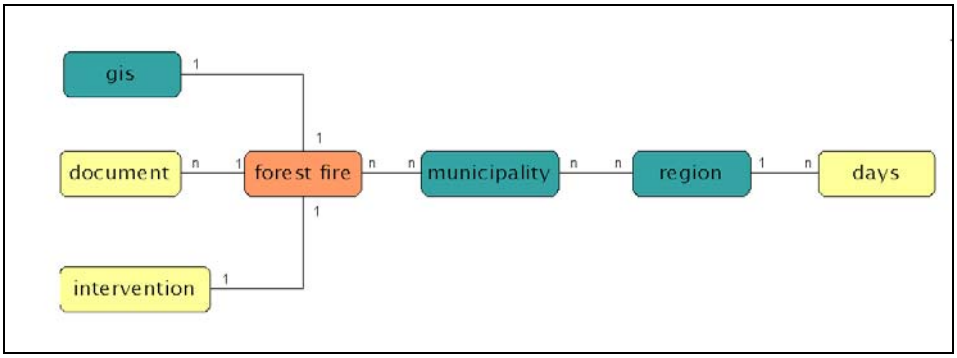

Figure 1. Simplified structure for the main tables of *Swissfire*

[1] www.wsl.ch/swissfire

Table 1. A short definition of the 7 main tables of *Swissfire*.

Main table:	***Description***
Forest fire	• Outbreak (place, coordinates, date and time, …) • Fire parameters (cause, estimated burnt area according to land cover, type of fire, …) • Forest parameters (type of forest, tree species, fuel type, damage, …)
Fire services	• Fighting (start and finishing times, strategy, total manpower, …) • Fighting costs (total costs, aerial fighting costs, …)
Document	• Document types related to fire events, such as area burnt maps, pictures, reports, videos, ...
GIS	• Geo-referenced data (polygon, fire perimeter, calculated area)
Municipality	• Municipality data (coding (outbreak/affected), possibly a new municipality reference)
Region	• Municipality groups, validity reference for the daily parameters
Days	• Daily parameters (holidays, fire bans, helicopter and forest service standby service, drought periods, wind conditions (e.g. Föhn day), selected fire danger indices, ...)

The database was implemented as an Oracle® Database. Fine-grained access to the own fire data for each canton is ensured using the Virtual Private Database (VPD) feature of Oracle®.

The main data-handling characteristics of the database are:

- Each type of fire that gets out of control may be considered as data (even very small wildfires are important for estimating ignition danger).
- Every fire event can be allotted to an outbreak municipality as well as to municipalities which have been affected.
- Multiple documents and document types can be stored and attached to each fire event, like images, videos, maps, reports.
- Changes in municipality attributes, such as fusions, may be easily updated every year from the newest data of the Swiss Federal Statistical Office FSO. All changes are tracked by a historical index allowing database queries on both options: current and historical municipalities.
- Municipalities may be grouped to *ad hoc* regions (meteorological regions, districts, macroregions such as Alps, Pre-Alps…).
- Relevant pyrological daily parameters, such as meteorological parameters, regional fire bans, cantonal holidays or celebration days, etc. can be easily defined and allocated to different regions. With this approach it is also possible to store many temporal municipality-related data, like population and land-use data. Through the date and the municipality, these parameters can be queried and related to each fire event.
- Through pl/sql routines, derived daily parameters, such as fire weather indices (e.g. Canadian Fire Weather Index and related sub indexes, Nesterov index, KBDI index), may be calculated for further processing.

Data management

The database is centrally managed by WSL. The data collection is carried out by the cantonal forest services, and usually involves filling out a form. The cantonal representatives collect the forms, check them and enter the data into the database or send the forms to WSL. In the near future the option for foresters to directly enter the data into the repository will be implemented. Each canton has full right of access with query, insert and update authorization of their own data.

At the time of writing (31/12/2008) the database consists of 7359 fire events (4043 with starting coordinates and 2213 with digitalized perimeters) ranging from the 19th century to present. The registered events originate mainly from Ticino (5916), Valais (934) and Grisons (452), which are the cantons with the longer tradition of collecting fire data. For all the other cantons data collection has just started (62 fires). For these cantons we will encourage archive research in order to quickly enhance the dataset on past fires.

A multilingual (English, Italian, German and French) web application acts as the communication platform between database and end-user (Fig. 2a,b). Different forms allow input, selection, view and export of fire event and daily pyrological data.

Queries may be performed in two ways: by an interface-assisted approach that allows the search keys to be entered directly in the mask by specifying selection criteria such as ranges of values or logic operators, or by entering a SQL query (including a library with templates of the often used queries).

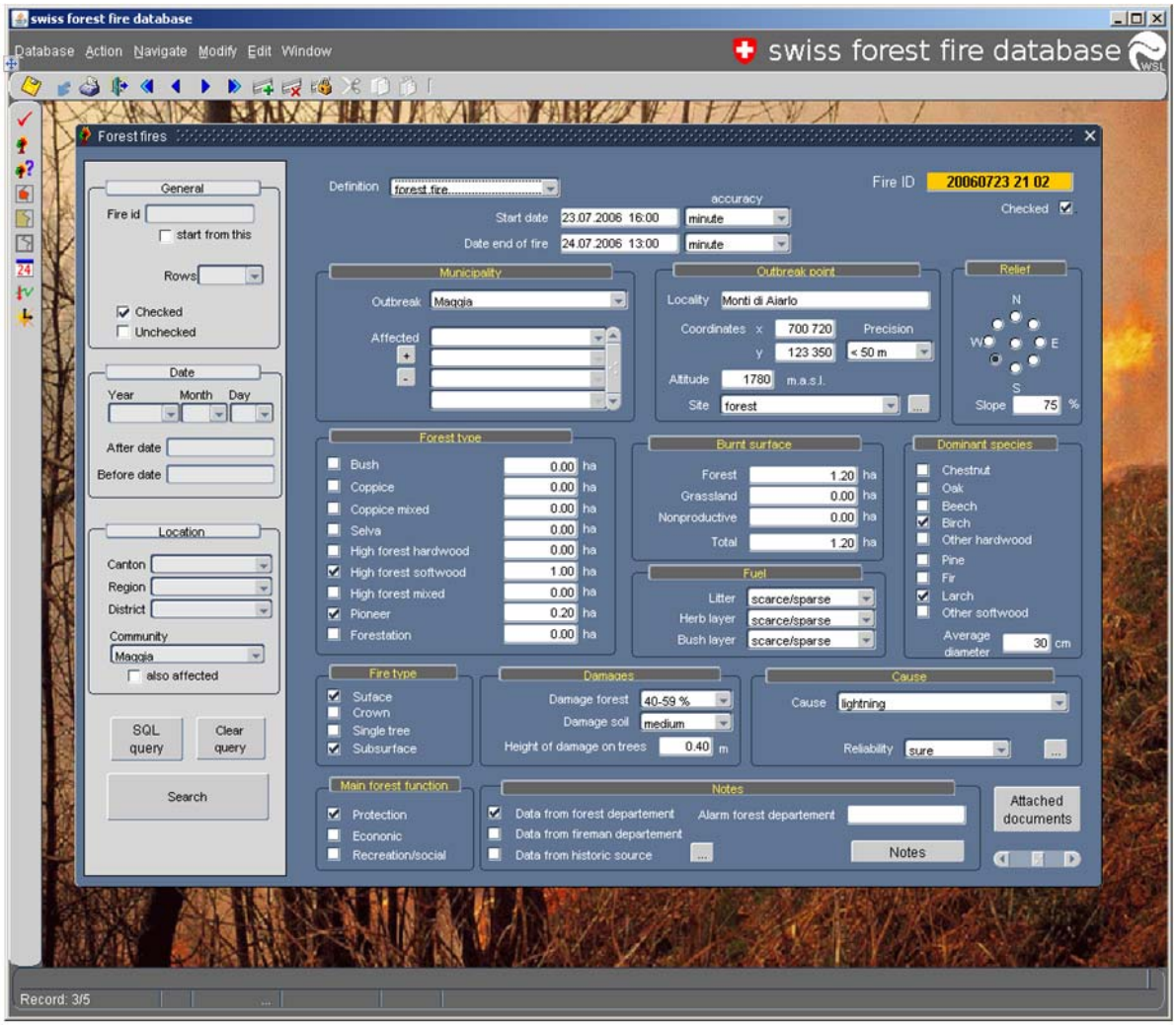

Figure 2a. Screenshot with an example of the English web application form for forest fire data

Producing fire statistics

A second web application (Oracle® Apex, Application Express) allows the automatic generation of yearly or periodic standard statistics, either as ready-to-print graphs (Fig 3a) or as data tables for further analysis (Fig 3b-c). Data tables may be assembled according to the user needs, defining the region of reference (from municipal to cantonal or national level according to the access rights), the period, the parameter to be summarized (number of fires, area), the fire seasons (winter, summer, year), and the cause of the fire.

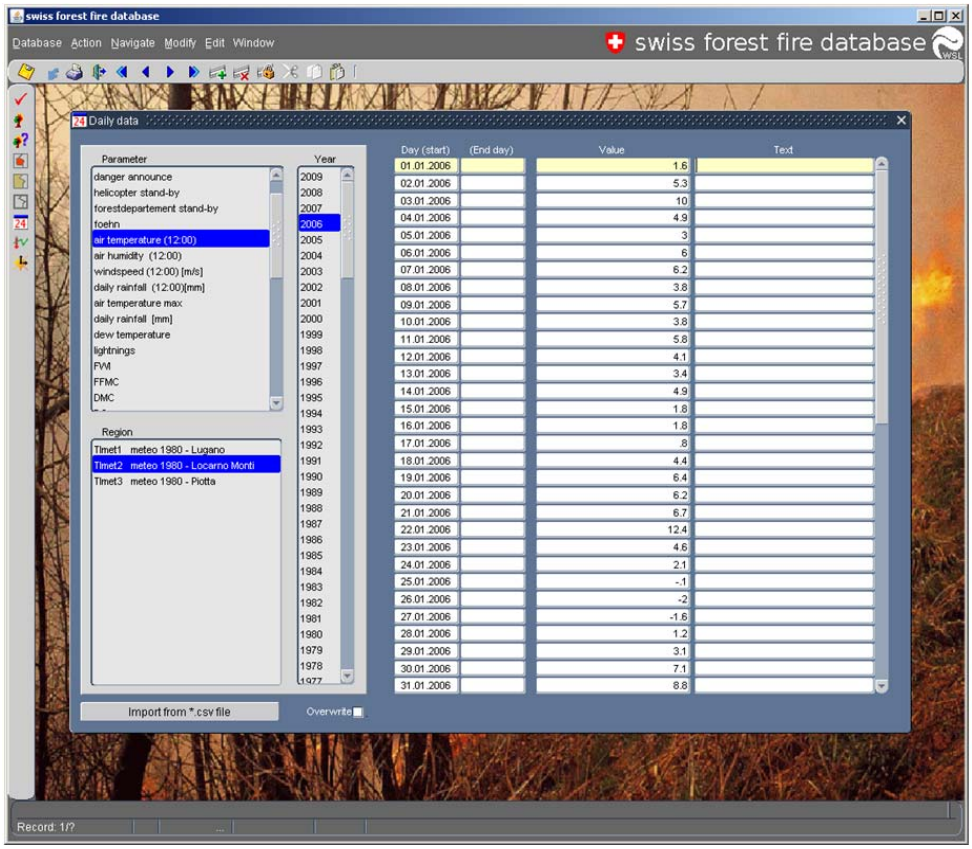

Figure 2b. Screenshot with an example of the English web application form for the daily pyrological parameters

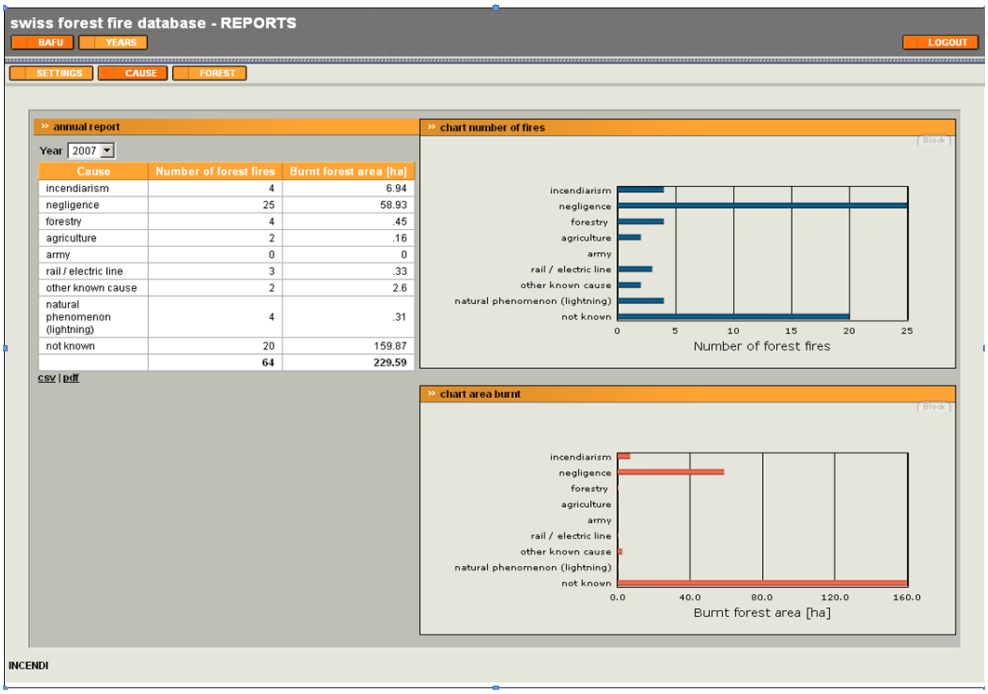

Figure 3a. Screenshot with an example of an English web application page for automatically generating fire statistic charts

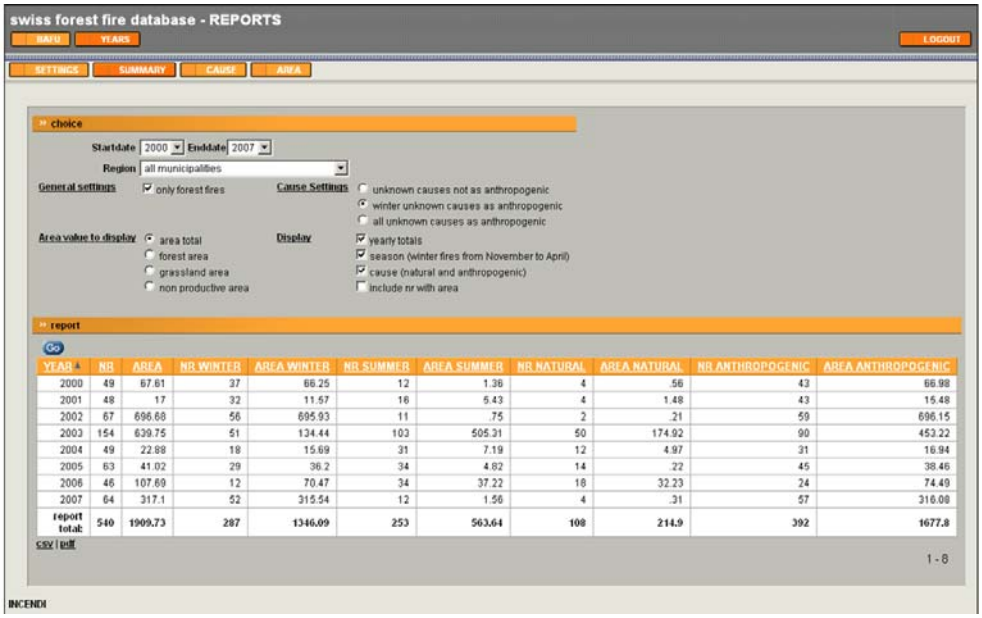

Figure 3b. Screenshot with an example of an English web application page for automatically generating exportable fire data tables

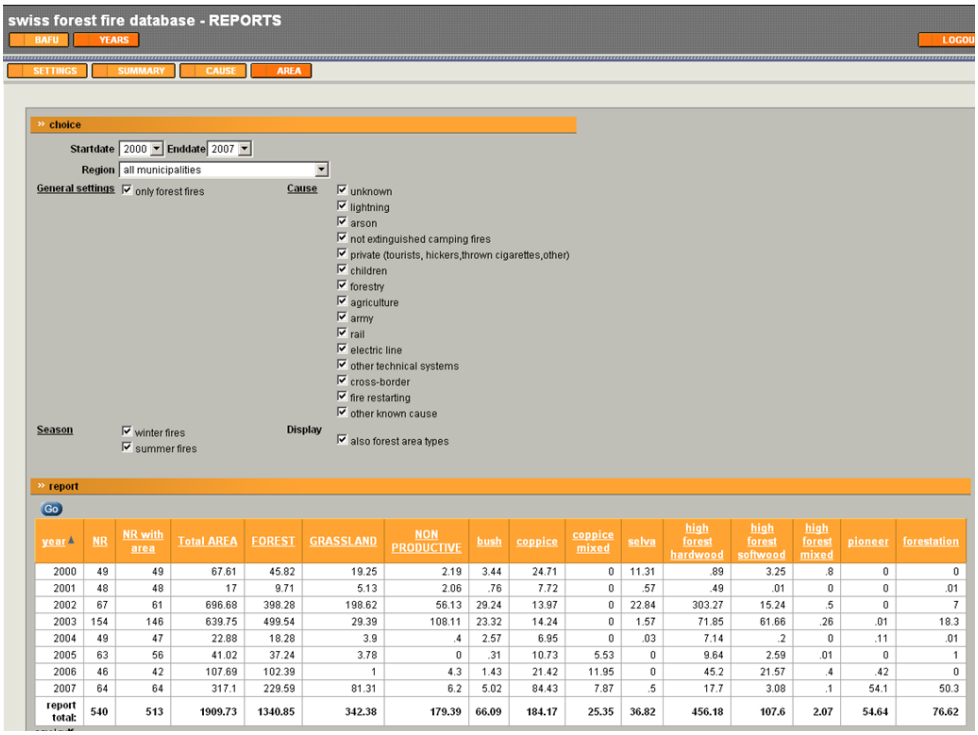

Figure 3c. Screenshot with an example of an English web application page for automatically generating exportable fire data tables

Further applications

Consistent and geo-referenced fire data allow advanced spatio-temporal analyses of fire occurrence and fire related parameters, such as meteorology, ignition causes, socio-economic context, legislation or ecological and social consequences. Such approaches may be used for implementing fire weather danger rating systems (Mandallaz and Ye, 1997), identifying areas with a high fire danger and fire risk (Conedera et al., 2005), analyzing long-term fire regime evolution (Pezzatti and Conedera, 2005; Conedera et al., 2006), checking the long-term effect of fire legislation or preventive measures (Conedera et al., 2004), highlighting fire selectivity with respect to vegetation cover (Pezzatti et al.

2009), or evaluating the ecological impact of different fire regimes (Marxer, 2003; Moretti et al., 2004; Moretti et al. 2006a, 2006b).

Conclusion

The new database is a flexible instrument which should help in future, to assure the homogeneity and completeness of Swiss fire data at the national level. With time, we expect to build a sufficiently large set of data for advanced statistics and analysis with a view to refine and optimize fire management strategies.

IFFN contribution by

Gianni Boris Pezzatti
WSL Swiss Federal Institute for Forest, Snow and Landscape Research
Ecosystem Boundaries Research Unit
Via Belsoggiorno 22
6500 Bellinzona
Switzerland

Silvio Schmid
FOEN Swiss Federal Office for the Environment
3003 Bern
Switzerland

Marco Conedera
WSL Swiss Federal Institute for Forest, Snow and Landscape Research
Ecosystem Boundaries Research Unit
Via Belsoggiorno 22
6500 Bellinzona
Switzerland

References

Condera, M., Corti, G., Piccini, P., Ryser, D., Guerini, F. and I. Ceschi. 2004. La gestione degli incendi boschivi in Canton Ticino: tentativo di una sintesi storica. Schweizerische Zeitschrift für das Forstwesen 155, 263-277.

Conedera, M., Roth, P., Corti, G. and D. Ryser. 2005 Valutazione del rischio di incendi boschivi a livello locale: una proposta metodologica. Schweiz. Z. Forstwes. 156, 331-337.

Conedera, M., Cesti, G., Pezzatti, G.B., Zumbrunnen T., and F. Spinedi. 2006. Lightning-induced fires in the Alpine region: An increasing problem. V International Conference on Forest Fire Research. Figueira da Foz, Portugal, 9.

Mandallaz D,R., Ye. 1997. Prediction Of Forest Fires With Poisson Models. Canadian Journal of Forest Research 27, 1685-1694.

Marxer, P. 2003. Oberflächenabfluss und Bodenerosion auf Brandflächen des Kastanienwaldgürtels der Südschweiz mit einer Anleitung zur Bewertung der post-fire Erosionsanfälligkeit (BA EroKaBr). Physiogeographica 33, 1-217.

Moretti, M., Obrist, M.K. and P. Duelli. 2004. Arthropod biodiversity after forest fires: Winners and losers in the winter fire regime of the Southern Alps. Ecography 27(5): 688-688

Moretti, M., M., Conedera, R., Moresi and A. Guisan. 2006a. Modelling the influence of change in fire regime on the local distribution of a Mediterranean pyrophytic plant species (*Cistus salviifolius*) at its Northern range limit. Journal of Biogeography 33, 1492-1502.

Moretti, M., Duelli, P., and M.K. Obrist. 2006b. Biodiversity and resilience of arthropod communities after fire disturbance in temperate forests. Oecologia 149, 312-327.

Pezzatti, B. and M. Conedera. 2005 Gli incendi di bosco: Cosa ci dice la statistica. Dati Statistiche e Società 4(1), 6-8, 10-13.

Pezzatti, G.B., Bajocco, S., Torriani D., and M. Conedera. 2009. Selective burning of forest vegetation in Canton Ticino (Southern Switzerland). Plant Biosystems 143, 609-620. 10.1080/11263500903233292.