8 FOREST FIRES

M. Conedera

8.1 INTRODUCTION

Forests vary significantly with the location. The following refers particularly to Alpine forests with a typical elevation of 500 to 2000 m a.s.l. in the moderate climate zone. In Switzerland most forest fires occur in the Southern part, a small region of 4'000 km^2 (10% of the total national area) with a forest cover of 44% (176'000 ha). Other minor fire-sensitive regions are the Northern part of the canton of Grison and the canton of Wallis.

8.2 FOREST FIRE DATA BASES

In 1992 a forest fire research project was started within the Swiss National Research Program 31 (NRP 31) *Climate Change and Natural Disasters* by the branch station south of the Alps of the Swiss Federal Institute for Forest, Snow and Landscape Research (FNP Sottostazione Sud delle Alpi). The NRP 31 project enabled to reconstruct fire data concerning date, time, duration, cause of ignition, area burnt, fire type, forest habitat, and other variables from more than 5500 fire events since 1900 (Conedera et al. 1993). This information has been organised in a relational database. A similar data base is now in progress for the canton of Wallis (Bochatay and Moulin 1998). The spatial and temporal analysis of wildfire occurrence has been studied for the canton of Grison through a case study (Langhart et al. 1998).

8.3 FIRE HISTROY

Based on the corresponding fire data base the fire history for southern Switzerland in this century has been recreated (Conedera et al. 1996). The significance of these factors was then verified by comparing the results with charcoal concentrations in recent sediments from the lake of Origlio (Tinner et al. 1998). The most notable aspect of fire regime development in this century is the general increase in the occurrence of fires since the sixties with a marked rise of summer fires since the seventies (Conedera et al. 1996, Fig. 8.1).

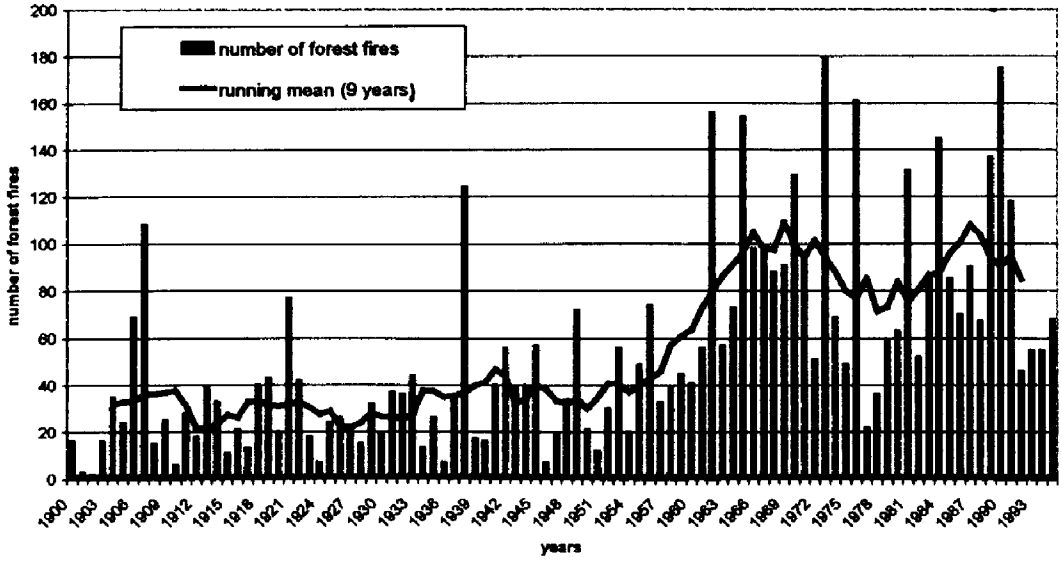

Fig.8.1 Development of number of fires and running mean (9 Years) in Southern Switzerland.

Paleoecological methods were used in order to reconstruct prehistoric forest fires and their possible effects on vegetation (Tinner and Conedera 1995, Tinner et al. 1998, Tinner et al. 1999, Berli et al. 1994). In southern Switzerland the highest fire frequency occurred in the Holocene during the Bronze and Iron ages due to anthropogenically induced fire (slash and burn practices, Tinner et al. 1999). All marked peaks in the charcoal curve since the Neolithic correlate with decreases of tree pollen (Tinner and Conedera 1995, Tinner et al. 1999).

8.4 EFFECTS OF FOREST FIRES

Different fire ecology studies on the effects of forest fires are being carried out. The main issues are:

- Post-fire vegetation reaction (tree, shrub and grass layer),
- Effects on invertebrate diversity,
- Post-fire runoff and soil erosion (splash and sheet erosion),
- Effects on soil water content,
- Effects on soil microorganisms.

Tab. 8.1: Swiss research activities on forest fires (state April 1999)

Institute	Unit	Group leader(s)	Field of activity	Participation EU-Projects
Swiss Federal Institute for Forest, Snow and Landscape Research	FNP Sottostazione Sud delle Alpi	Marco Conedera Peter Marxer Marco Moretti	Fire ecology, Fire management	Minerve II; Prometheus s.v.
	ecological processes	Peter Blaser	Effects on soil	
	Biodiversity	Peter Duelli	Effects on invertebrates	
	landscape dynamics and management	F. Schweingruber	Dendroecology	
	avalanche dynamics	Perry Bartelt	Modelling	Inflame
ETH Zurich	D-WAHO	Daniel Mandallaz	Risk prediction	Minerve II
University of Berne	Geobotanic Institute	Brigitta Ammann Willy Tinner	Palaeohistory	
	Department of Geography	Helmut Elsenbeer	Effects on soil	
University of Zurich	Department of Geography	Britta Allgöwer Andreas Bachmann	Modelling Fire Management	Minerve II; Inflame
University of Lausanne	Institute of Botany	Pierre Hainard	Effects on vegetation	
University of Basel	Department of Geography	Helmut Leser C. Wüthrich	Effects on soil	

Although these studies are going on, first results for the chestnut forests in southern Switzerland are available:

- Repetition of fires leads to an impoverishment of the vegetation towards fire-tolerant species (Delarze et al. 1992, Hofmann et al. 1998, Berli 1996),
- This development is not only dependent on the original floristic composition, but also on the survival strategies of the different species (Hofmann et al. 1998),
- Long-term repeated fires lead to a reduction of the nutrient level (Marxer et al. 1998, Delarze et al. 1992, Hofmann et al. 1998),
- Forest fires increase soil erosion, runoff and risk of debris flow. The magnitude of this effect seems to be a function of fire severity (Marxer et al. 1998),
- In burned areas the richness of species of many faunistic groups (spiders, carabids, ants) is higher than in unburned areas (Moretti et al. 1998),
- Distribution of the species' abundance of the burned areas reflect typically an unstable (disturbed) and dynamic ecosystem (Moretti et al. 1998),
- Different fire regimes (fire frequency and time elapsed since the last fire) have clear effects on faunistic diversity (Moretti et al. 1998).

8.5 FIRE RISK PREDICTION

The general increase in the occurrence of forest fires since the sixties (Conedera et al. 1996) makes it increasingly necessary to improve the *forest fire risk prediction methods*. Different fire risk prediction approaches are operational or in development in Switzerland:

- Statistical model based on the Poisson distribution (Mandallaz and Ye 1997),
- Hybrid expert system for the spatial prediction of wildfire danger (Bolognesi 1996),
- GIS-based framework for wildfire risk assessment (Schöning et al. 1997).

Due to the anthropogenic origin of most fires, factors describing human activities (i. e. weekends or holidays) had to be integrated in fire risk forecasts (Mandallaz and Ye 1997).

Fig.8.2 Forest fire in Sta. Maria (Misox) in April 1997.