

10. Switzerland: Swiss National Park Biosphere Reserve

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INTRODUCTION

Founded in 1914, the Swiss National Park (SNP) was designated a biosphere reserve in 1979 and was, at that time, the first biosphere reserve in Switzerland. Today, the Biosphere Reserve consists mainly of the National Park area, which is completely protected from anthropogenic pressure. In 2000 the failure of an attempt to create a peripheral zone around the Park caused the National Park authority to change its strategy. Currently a project is in preparation to create a Biosphere Reserve National Park/Müstair Valley in cooperation with the regional board of the Müstair Valley. The Müstair Valley, and notably the medieval Abbey of Müstair, is one of four sites in Switzerland on UNESCO's Cultural World Heritage.

LOCATION

The Swiss National Park (SNP) has a surface area of 172 km² and is located in the Central Alps, in the most eastern part of the Switzerland in the canton of Grisons. It consists of mountain ranges and valleys situated between the Inn valley (1,000 to 1,800 m above sea level) in the north and the Italian border to the south. The SNP boundary embraces the Italian border and the Italian Stelvio National Park. The planned Biosphere Reserve, SNP/Müstair Valley will create a large contact zone between SNP and Stelvio National Park and enhance conditions for international cooperation within both Parks.

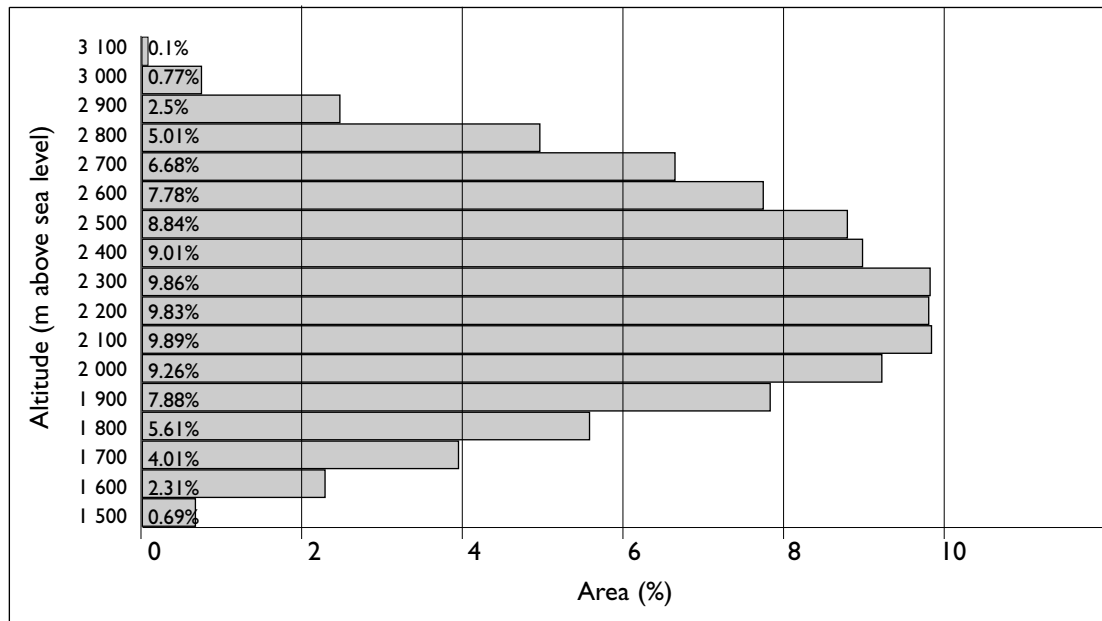
The SNP includes subalpine, alpine and nival zones, from 1,400 m up to 3,173 m above sea level with a permafrost zone above 2,500 m. As shown in Figure 10.1, most of the Park area is located between 1,700 m and 2,800 m. From a geographical point of view, the Park includes portions of six main valleys and a series of ranges and peaks within the altitudinal range of 2,600 and 3,100 m, most of which are composed of limestone or dolomite.

Human impacts are associated with two linear features that cross the SNP: the road from Engadine to Müstair Valley and the River Spöl, which is managed by a hydropower company. It must be emphasized that human impacts on in the National Park and its surroundings are not intensive and external effects of these activities on the Park are very low.

VEGETATION ZONES

The main vegetation types in the Swiss National Park are subalpine forests (dominant: *Pinus mugo*;

Figure 10.1
SNP area by altitude



28 per cent), alpine grassland (dominant: calcareous; 21 per cent) and rocks/debris (51 per cent). The vegetation of the larger region is more varied and includes a montane zone, agriculturally formed vegetation and silicious vegetation (see Table 10.1).

CHARACTERIZATION OF THE SITE ABOVE THE TREE AND VEGETATION LINE

The natural treeline in the SNP is situated at a height of 2,300 to 2,400 m, but in some areas it has been depressed by former cattle grazing. There is no clear climatically determined vegetation line. In many cases, areas with sparse vegetation on rocks and debris occur due to morphodynamic processes and continuous erosion. However, areas above 3,000 m generally lack vegetation.

Ecosystems above the treeline are dominated by calcareous/dolomitic bedrock and corresponding geomorphic processes (debris formations, karst, soil formation). Permafrost is widespread above 2,500 m (several rock glaciers, earth streams and so on) but there are no true glaciers in the park.

DEMOGRAPHIC AND ECONOMIC CHARACTERIZATION

Swiss National Park

There are no permanent residents within the National Park, though two hotels open during the holiday season employing a total of about twenty staff (the SNP is closed during the winter). Tourism generates added value for the regional economy, adding CHF17 million per year (4.25 per cent of the GDP), which ensures full-time employment for 120 (minimum) to 200 (maximum) people (Küpfer, 2000).

	km ²	% belt	% area
Montane: subalpine belt			
Forest	295.5	64.8	22.8
Hedges	3.3	0.7	0.3
Grassland, dry	2.4	0.5	0.2
Pastures, low fertility	86.4	18.9	6.6
Pastures, high fertility	39.2	8.6	3.0
Fields	0.8	0.2	0.1
Wetland	3.5	0.8	0.3
Rocks and debris	25.0	5.5	1.9
Total zone	456.1	100	35.2
Alpine: nival belt			
Heathland	29.5	3.5	0.3
Grassland	290.3	34.4	22.4
Calcerous	75.9		
Calcerous/silicious	95.8		
Silicious	118.8		
Wetland	3.5	2.4	0.4
Rocks and debris	517.7	61.6	39.7
Total zone	841.0	100	64.8
TOTAL	1 297.1		100

Table 10.1

Vegetation in the SNP-region, Lower Engadine, Müstair Valley (Zoller, 1995)

Neighbouring Region

Tourism is the most important economic sector for the sixteen neighbouring communities, which are part of three administrative regions: the Upper and Lower Engadine, and the Müstair Valley. These communities have a permanent population of 8,800 inhabitants (1999), with 5,074 in full-time employment (1995). In economic terms, the primary sector accounts for 8.1 per cent of full-time employees and 5 per cent of the regional GDP; the secondary sector for 27.3 per cent of full time employees and 19 per cent of regional GDP; the tertiary sector for 64.5 per cent of full time employees and 76 per cent of regional GDP (Küpfer, 2000).

In the sixteen communities, there are 3,900 beds in hotels, 5,300 beds in apartments and 2,700 beds in group lodgings. In addition, there are almost 900 camping places. During the summer season tourists spend in total 603,000 nights (1998) in the region, which corresponds to 51 per cent of total nights annually.

ONGOING GLOBAL CHANGE PROGRAMMES AND INDIVIDUAL RESEARCH PROJECTS

Global change issues in the SNP are addressed mainly by long-term monitoring programmes as well as associated individual research projects that explore specific aspects of political or scientific relevance.

A significant component of the independent research projects deals with the modeling of future changes and developments. Research is concentrated in two main areas, the area of Il Fuorn and the Trupchun Valley, so as to protect other areas from long-term disturbance by scientists.

Long-Term Monitoring Programmes

Table 10.2 lists all the long-term projects and monitoring programmes undertaken in the SNP. There are almost fifty programmes and projects being carried out, covering most aspects of geological and biosphere related research (although there is a lack of socioeconomic monitoring). A number of programmes (vegetation, forest, ungulates, climate) began shortly after the foundation of the Park and have been providing data for more than fifty years. Most of the programmes have been operational for a period between ten to fifty years. Newly installed programmes (post-1990) focus on zoology, interdisciplinary monitoring projects and sites affiliated with global monitoring programmes.

A significant advantage of these monitoring programmes is the high security of permanent plots and monitoring instrumentation situated in the Park, which ensures the long-term continuity of data.

Of a total of fifty programmes and projects, some thirty-five are of relevance for detecting global change phenomena, and fifteen of them are highly relevant and important. Two programmes particularly worth noting are part of the global monitoring programmes, GLORIA (Global Observation Research Initiative in Alpine Environments) and IMP, which is part of the LTER (Long-Term Ecological Research) network. Six of the programmes are part of national monitoring programmes or networks. Although most of the programmes were designed and established specifically for the Swiss National Park, they are carried out with the use of scientifically accepted monitoring methods as far as possible.

Research Projects

In addition to the monitoring programmes, some twenty to thirty research projects are currently being carried out in the Park annually, many of which are led by young scientists (PhD thesis, diplomas) or within the framework of international projects (EU-FRP, Interreg). Some ungulate projects are carried out in common with the Stelvio National Park (Italy). A wide range of topics is covered by the individual projects, which vary from year to year.

Integrated Research Programmes of the Swiss National Park

Since 2000, research in SNP has been focused on four interdisciplinary research programmes. Within the next ten years, the relevant scientific issues and expertise should be well established and synthesized for the following topics:

- issues of global change in the National Park region
- ungulates in alpine habitats

- the role of disturbances in ecosystem evolution
- Interactions between the Swiss National Park and society.

Organization, Resources, Implementation

Research in the SNP is managed by the SNP Research Council in close cooperation with the Park's administration. For research coordination and GIS (Geographic Information Systems), two full-time employees have been engaged, one by the Research Council and one by the SNP.

Financial running costs (including personnel) amount to US\$350,000 annually. Collaborating research institutes and institutions finance the majority of the monitoring and research projects at an estimated cost of US\$750,000 annually. In total, approximately US\$1.1 million is invested in SNP research. Research findings are used in National Park management of tasks such as regulation of ungulate populations, slope stability/risks, restoration of the dammed River Spöl, planning (fire control), and information dissemination.

Availability of Data

Permission is required from the Swiss National Park to carry out monitoring programmes and research projects, and thus all data originating from the research is considered to be the property of the Park. A significant body of past data exists, chiefly in paper or published form; many appear in the series *Nationalpark – Forschung in der Schweiz* (National Park – Research in Switzerland); so far ninety-one issues have been published. Copies can usually be obtained in the archives of the National Park Centre in Zernez or at the Museum of Nature in Chur. In an unpublished report dated 1986, all known data sources prior to 1986 are listed.

The storage of information by electronic means has only been instigated in recent years. To achieve this, the SNP has developed its own spatial data system, GIS, and is in the process of integrating data into GIS-related databases.

Important rock samples (specimens, rocks, etc.) from SNP are for the most part deposited in the Museum of Nature in Chur while others are sent to other specialized Swiss institutes or museums.

Table 10.2
Monitoring and long-term programmes in the Swiss National Park

Source: Research Council of the Swiss National Park

(Key on page 92)

Programme	Number of stations/plots	Leading house	Start of data series
CLIMATE			
METEOROLOGICAL STATIONS			
ENET-Station Buffalora 1900m	1	MeteoSwiss	1917
IMP Stabelchod Forest 1900m	1	WSL	1996
IMP Stabelchod Pasture 1900m	1	WSL	1996
Munt Chavagl 2400m	1	FoK	1969/1998
<i>Trupchun 1800m</i>	1	SNP/FoK	1992
PRECIPITATION/SNOW			
Annual precipitation	3	MeteoSwiss	1918/1955/1973
<i>Forest Avalanches</i>	Park	SNP/SLF	1996
<i>Snow level records</i>	5	SNP/SLF	1996
PHENOLOGY			
Plant Phenology (Stations)	30	MeteoSwiss/ SNP	1995
VEGETATION/ TERRESTRIAL ECOSYSTEMS			
FOREST			
Stock stability	5	WSL	1925/1933
<i>Stock growth</i>	12	ETHZ	1979
<i>C: IMP (Integ. Monitoring Programme)</i>	1	WSL	1996
<i>Swiss Forest Inventory</i>	55	WSL	1990
PHANEROGAMES AND KRYPTOGAMES			
Vegetation plots	160 plots	WSL	1917/1939
<i>C: Burnt Area of Il Fuorn</i>	13 plots/1 Trans.	FoK	1952
<i>Mosses (Forest)</i>	1 with 20 plots	FoK	1954
<i>Sowed banks (plots)</i>	10 sites	ETHZ	1969
C: Exclosures SNP	27 sites	FoK/GR	1992
GLORIA-SNP	8 summits	FoK	2002
<i>Lichens</i>			interrupted
EARTH AND LANDSCAPE			
SOIL			
Swiss Soil Monitoring Prog. (2300m)	1	FAL	1993 (every 5 years)
PERMAFROST, ROCK GLACIERS (RG)			
Earth Streams Munt Chavagl	1	FoK	1969
<i>RG Val Sassa</i>	1	ETHZ	1917
<i>RG Val da l'Acqua</i>	1	ETHZ	1930
<i>RG Macun</i>	1	Uni Jena	1968

Programme	No. of stations/plots	Leading house	Start of data series
LANDSCAPE			
Inventory of natural events and disturbances	Park	SNP/FoK	1987
Landscape Monitoring (remote sens.) (HABITALP)	Park	SNP/FoK	2002-2005
Landscape perception	1 Parcours	WSL	1999 (first cut only)
FAUNA			
UNGULATES (RED DEER, CHAMOIS, CAPRICORN, ROE DEER)			
Stock of ungulates	Park	SNP	1914
Activity pattern of Ungulates Species	2 areas	SNP	1995
Use of living space by ungulates	3 areas	SNP	1990
BIRDS			
<i>Subalpine forest</i>	2	SV Sempach	1998
<i>Alpine pastures</i>	1	SV Sempach	1996
Gypaetus		GWB	1991
Snowgrouse	1	SNP	1995
Black grouse	1	SNP/GR	1990
Trans-section Champlönch	1	-	interrupted
Route assessment Schifferli	80 km	-	interrupted
INVERTEBRATES			
<i>Ant colonies</i>	2	FoK	1954
<i>Monitoring of rare species</i>	Park	SNP	1960
Rapid Biodiversity Assessment alp.	2	WSL	2000 subalp./2004
<i>Butterflies</i>	5	SNP	2000
<i>Biodiversity-Monitoring CH</i>	3	BUWAL	2002
HYDROSPHERE/WATER ECOSYSTEMS			
HYDROLOGICAL STATIONS (RIVERS)			
Punt dal Gall/Spöl	1	BWG/LHG	1952
La Drossa/Ova Fuorn	1	BWG/LHG	1960
Ova Cluozza	1	BWG/LHG	1961
HYDROBIOLOGY			
<i>C: Monitoring river ecology</i>	9	FoK	1996
<i>C: Experimental floods in Spöl</i>	6	FoK	1990, 1995, 2000–2
C: Monitoring of the Macun Lakes 2400m	5	SNP/FoK/EAWAG	2002
<i>C: Monitoring Springs Fuorn</i>		Uni Berne/EAWAG	in prep.
Water mites Bluogls	1	-	1977–88 interrupted

Table 10.2
 Continued

Table 10.2 Key

Programmes in *italic type* are of direct relevance for global change monitoring.

Programmes in **bold type** are the most important monitoring programmes for global change issues.

SNP	Swiss National Park
FoK	Research Council of the Swiss National Park
WSL	Swiss Research Institute of Forest, Snow and Landscape
SLF	Swiss Research Institute of Snow and Avalanches (incorporated in WSL)
ETHZ	Swiss Federal Institute of Technology
BWG/LHG	Swiss Agency of Water and Geology / Hydrological Service
BUWAL	Swiss Agency of Environment
SV Sempach	Swiss Institute of Ornithology Sempach
GR	Canton of Grisons
EAWAG	Swiss Federal Institute for Environmental Science and Technology
Uni	University
GWB	Society for the Reintroduction of the Gypaetus