

# Influence of red deer on vegetation change of tall-herb communities.

## A long-term study in the Swiss National Park.

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### Introduction

In 1914, the Swiss National Park (SNP) was founded in the Engadin (Central Alps). To investigate the vegetation change - especially to determine the speed at which subalpine meadows and pastures previously kept open by Man and livestock are invaded by trees - Braun-Blanquet (1931) and Stüssi (1970) established from 1917 on about 200 permanent plots in the SNP and studied their phytosociology at more or less regular intervals.

Since 1920, the number of red deer (*Cervus elaphus* L.) ranging in the SNP (169 km<sup>2</sup>) during the vegetation period, has increased from 20 to about 1800 in 1995.

### Methods

The relevés of 9 permanent plots (Table 1) with original tall-herb communities (*Chenopodietum subalpinum* Br.-Bl. 1948) were analysed. Classification (minimum variance clustering) and ordination (principal coordinate analysis) were calculated with the MULVA-5 program package by Wildi & Orłóci (1995).

Table 1: Facts about permanent plots with original tall-herb communities in the Swiss National Park (SNP).

Plot number	Alp Stabelchod		Plan dals Poms		Alp Murter		Alp la Schera		Val Mingèr	
	Tr 1	Tr 6	Ac 1	Ac 9	De 1	De 2	Mi 16	Mi 80		
Altitude (m a.s.l.)	1950	1964	2335	2320	2087	2084	1710	2160		
Aera (m <sup>2</sup> )	4	16	50	32	9	9	9	9		
Begin reservation period	1919	1919	1911	1911	1914	1914	1912	1912		
Observation period	1941-1994	1921-1994	1922-1994	1917-1982	1939-1996	1939-1996	1942-1996	1943-1996		
Number of relevés	11	12	12	10	11	10	10	9		

### Results

- 9 different vegetation types were detected with classification (Table 2). Groups A-E belong to tall-herb communities, groups F-H are dominated by *Festuca rubra*. Group H: Bare ground dominated by *Poa alpina* and *Poa annua* kept open by red deer scraping.
- On 5 plots, vegetation changed from tall-herb community to a sward dominated by *Festuca rubra* (Fig. 1).
- Between 1938 and 1958 vegetation changed on all permanent plots (Fig. 2).

Table 2: Characteristic species and their average cover (%) of the 9 resulting vegetation types (A-I) after classification.

Group	A	B	C	D	E	F	G	H	I
Rumex alpinus	69.6			2.2					
Stellaria nemorosum	5.0	2.5		4.9					
Chenopodium bonus-henricus	2.5	2.7						0.4	
Urtica dioca	0.2	9.4	10.5						
Aconitum napellus	34.7	5.3	67.6	31.1		0.9	0.2		
Poa pratensis	0.1	29.5	11.9	5.8	8.9		0.8	7.2	1.7
Deschampsia caespitosa	3.3		5.3	67.6	39.8	26.9		4	2.9
Achillea millefolium	5.3			10.3	3.2	9.3		13.5	0.1
Ranunculus acer	0.2	4.8	0.5	0.5	4.1	3.8	10.4	1.3	3.8
Festuca rubra		12.6	9.5	0.6	6.3	44.8	43.1	37.2	1.7
Trisetum flavescens		14.2			1.2		3	13.7	
Trifolium repens		2.8	0.6		2.9	5.3	9.6	12.5	0.9
Galium pusillum		1.7		0.8	2.2	0.8	2.1	13.7	
Briza media							1.5	10.8	
Poa alpina	0.5	0.3	0.1	5.1	1.7				34.6
Poa annua		2.8			0.3				45.8

**References**  
 Braun-Blanquet, J., 1931: Vegetationsentwicklung im Schweizerischen Nationalpark. Ergebnisse der Untersuchungen von Dauerbeobachtungsflächen I. Jahresber. Naturforsch. Ges. Graubündens, N.F. 69, p. 3-82.  
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 Wildi, O., Orłóci, L., 1996: Numerical exploration of community patterns. A guide to the use of MULVA-5. SPB Academic Publishing, Amsterdam, 2nd ed.

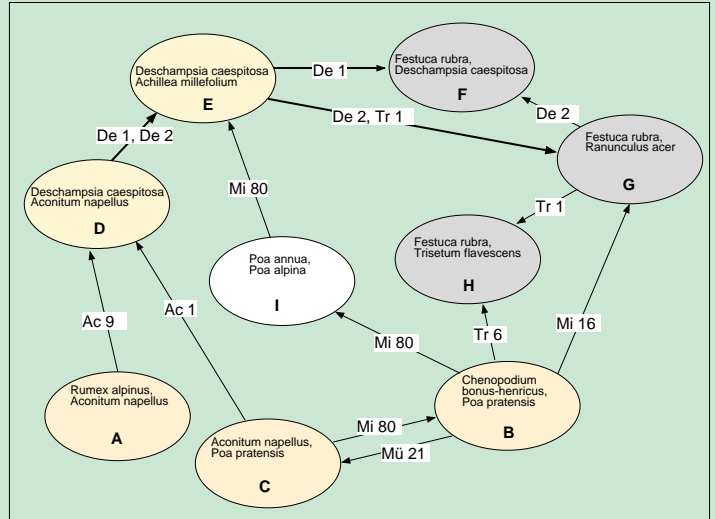


Fig. 1: Observed plot transitions among vegetation types (A-I).

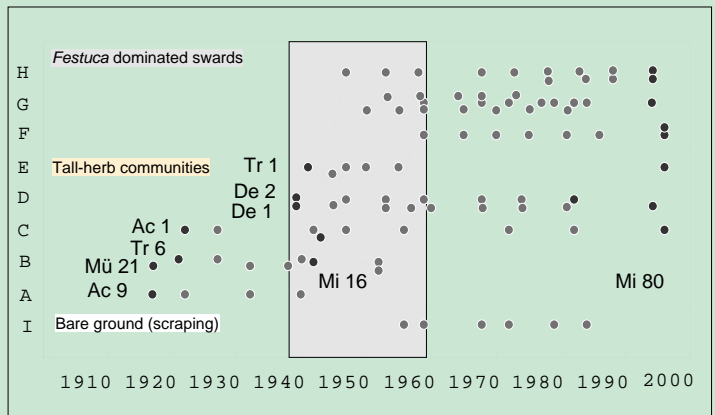


Fig. 2: Succession stages of each plot during the observation period. Changes occurred on each plot during 1938 - 58 (marked grey). Points = relevés. A-I = vegetation types.

### Vegetation changes due to red deer

- Trampling effects of red deer, grazing of marmots and the ceasing import of nutrients from former livestock grazers may have caused and / or accelerated the decrease of *Aconitum napellus* cover and the increase of *Deschampsia caespitosa* cover on the plots Ac 9 and Ac 1.
- The temporary dominance of *Poa alpina* and *Poa annua* on plot Mi 80 was due to scraping by red deer.
- Red deer grazing is the most important factor for the fast change to the *Festuca rubra* dominance.
- Today's sward-like structure of five permanent plots and its *Festuca* dominance is an effect of the permanent intensive grazing by red deer.