

## **Interdisciplinary monitoring project of subalpine mountain hay meadows in Hohe Tauern National Park (Carinthia)**

### **A model for extensive cultivation and preservation of these endangered ecosystems, their biodiversity and their species interactions**

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#### **Abstract**

This paper presents a management concept for the subalpine mountain hay meadows "Pockhorner Wiesen" developed for the Carinthian Administration of Hohe Tauern National Park. It consists of a proposal for their cultivation by a maintenance plan and a long-term interdisciplinary monitoring concept. A comparison of different mowing intervals is designed to establish how often the meadows should be cut to ensure a maximum of biodiversity with a minimum of labour and to sustain the existing interspecific relationships. The monitoring employs vegetation-ecological and pollination-biological methods. The former document the dynamics in the various phytocoenosis of the ecosystem. The latter are – due to the high numbers of flowers and the great variety of pollinators – perfect parameters for the study of animal-plant relationships in mountain hay meadows.

The ideal conditions for research in Hohe Tauern National Park promote the development of innovative methods for advanced environmental management. The direct application of scientific results in a management concept provides a resource that can be of use both theoretically and practically in the cultivation and conservation of these endangered ecosystems.

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#### **Keywords**

Mountain hay meadows, monitoring, vegetational ecology, floral ecology, Hohe Tauern National Park, Austria

#### **Project aims and duration**

The Pockhorner Wiesen, traditionally cultivated mountain hay meadows of high biodiversity, are at risk from progressive abandonment and forest encroachment. On behalf of the Administration of the Carinthian section of the National Park, a management concept was developed to guarantee the long-term survival of the meadows. It provides for their targeted cultivation within the framework of a maintenance plan and the evaluation of the results through interdisciplinary vegetation- and flower-ecological monitoring. The aim of the project is to determine how often the plant communities characteristic of this area should be mowed to preserve the diversity of the plant species and flower-visiting insects and to maintain their manifold interspecific relationships. This shall help to explain the succession processes in abandoned mountain hay meadows in the Alps.

The project has a duration of 7 years and includes subsequent evaluations at intervals of several years. The pilot phase was carried out in 2003.

#### **Area of study**

##### Location

The Pockhorner Wiesen are located on the southern slopes of the Alps in the buffer zone of Hohe Tauern National Park. The area is inclined up to 35° and comprises around 100 hectares at 1950-2400 m above sea level (fig. 1).

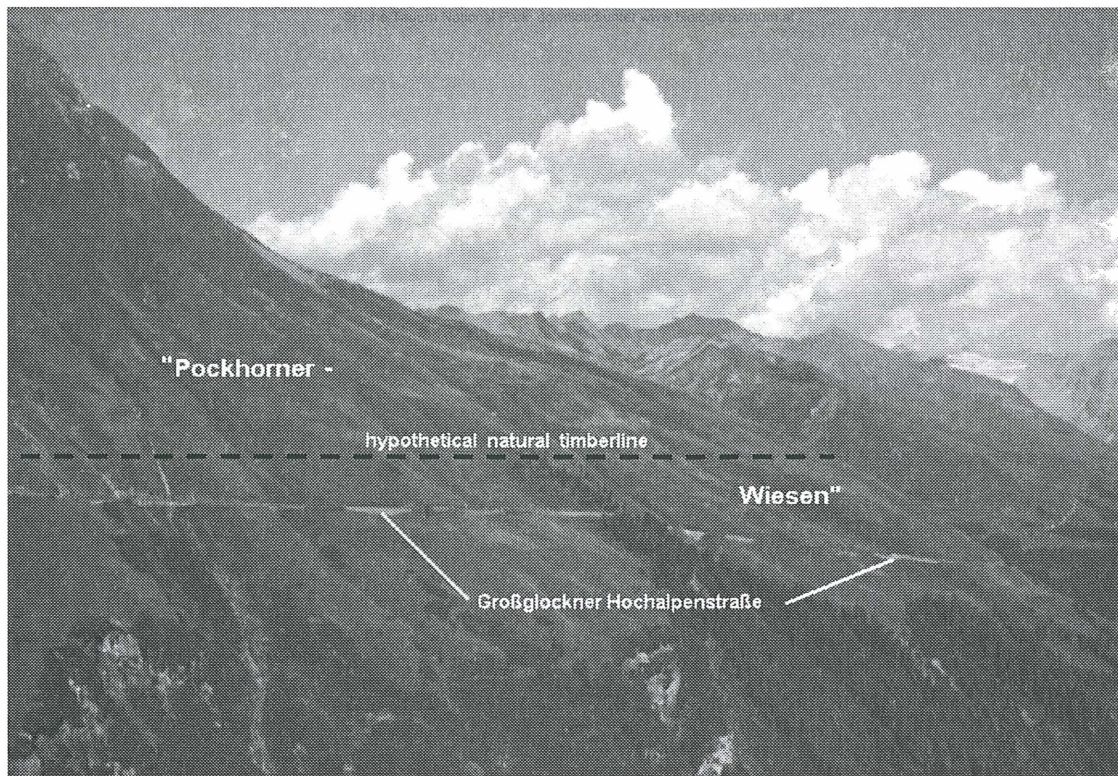


Fig. 1: Location of the mountain hay meadows "Pockhorner Wiesen" directly above the Großglockner Hochalpenstraße highway with actual and hypothetical natural timberline, marked by the dashed horizontal line.

### Flora and vegetation

With their 208 vascular plant species (ABL 2003), the meadows are probably among the most species-rich ecosystems of the Park. This author also identified eight plant-communities here, including meadow communities like *Hypochoerido uniflorae-Festucetum paniculatae*, *Campanulo scheuchzeri-Festucetum noricae*, *Trifolio nivalis-Seslerietum albicantis* or heaths like *Junipero-Arctostaphyletum*. The bi-annually mowed subalpine-alpine *Sieversio-Nardetum strictae* includes up to 61 Species per 25m<sup>2</sup>.

### Pollination ecology

The high number of blossoms, a prominent feature of the Pockhorner Wiesen, is the basis for the impressive diversity of flower-visiting insects and for the multifold plant-pollinator relationships (KREISCH 2001a). 140 anthophilous insect species belonging to 4 orders and 34 families have been identified on their visits to 130 entomophilous plant species. Diptera were more abundant than hymenoptera and lepidoptera, while coleoptera make up only a small percentage in the pollinator fauna.

### Risk from progressive abandonment

Today, less than 20% of the area is mowed either bi-annually or more sporadically. In areas that have lain fallow for more than 20 years, the biodiversity of the flora is up to 25% lower than in the areas that are mowed bi-annually. The presence of flowers even decreases twice as fast with progressive abandonment. The lower section of the mountain hay meadows, which is situated on ground originally covered by forests (cf. fig. 1) and which today contains the most species-rich and therefore most precious part of the ecosystem, is further threatened by the renewed encroachment of shrubs and trees into the meadows (KREISCH 2001b).

### **Maintenance plan**

A maintenance plan based on ABL (2003) applies three concurrent agricultural strategies in three altitudinal zones to stop succession in a large portion of the hay meadows (fig. 2):

1. continued bi-annual to sporadic mowing of the lots directly above the Großglockner Hochalpenstraße mountain road
2. regular mowing alternating with short fallow periods in the middle section
3. wilderness area in the highest lots



The objective of the inter-disciplinary monitoring is to determine the effects of different mowing rhythms on the phytocoenosis and their pollinator communities. For that purpose, permanent plots of 25 m<sup>2</sup> size each will be established in the five selected plant communities mentioned above and mowed at intervals of two, four and six years (tab. 1). An unmowed plot serves as a control area (cf. KREISCH & ABL in print).

To document the development of plant communities relevés of the vegetation will be taken. Additionally the vertical and horizontal structure of the vegetation will be examined in detail. Changes in the availability of blossoms for anthophilous insects will be determined by counting the numbers of flowers and measuring the production of nectar (standing crop). The continuity of the plant-pollinator relationships will be ascertained by examining the spectrum of visitors to each plant species and their behaviour while on the blossoms.

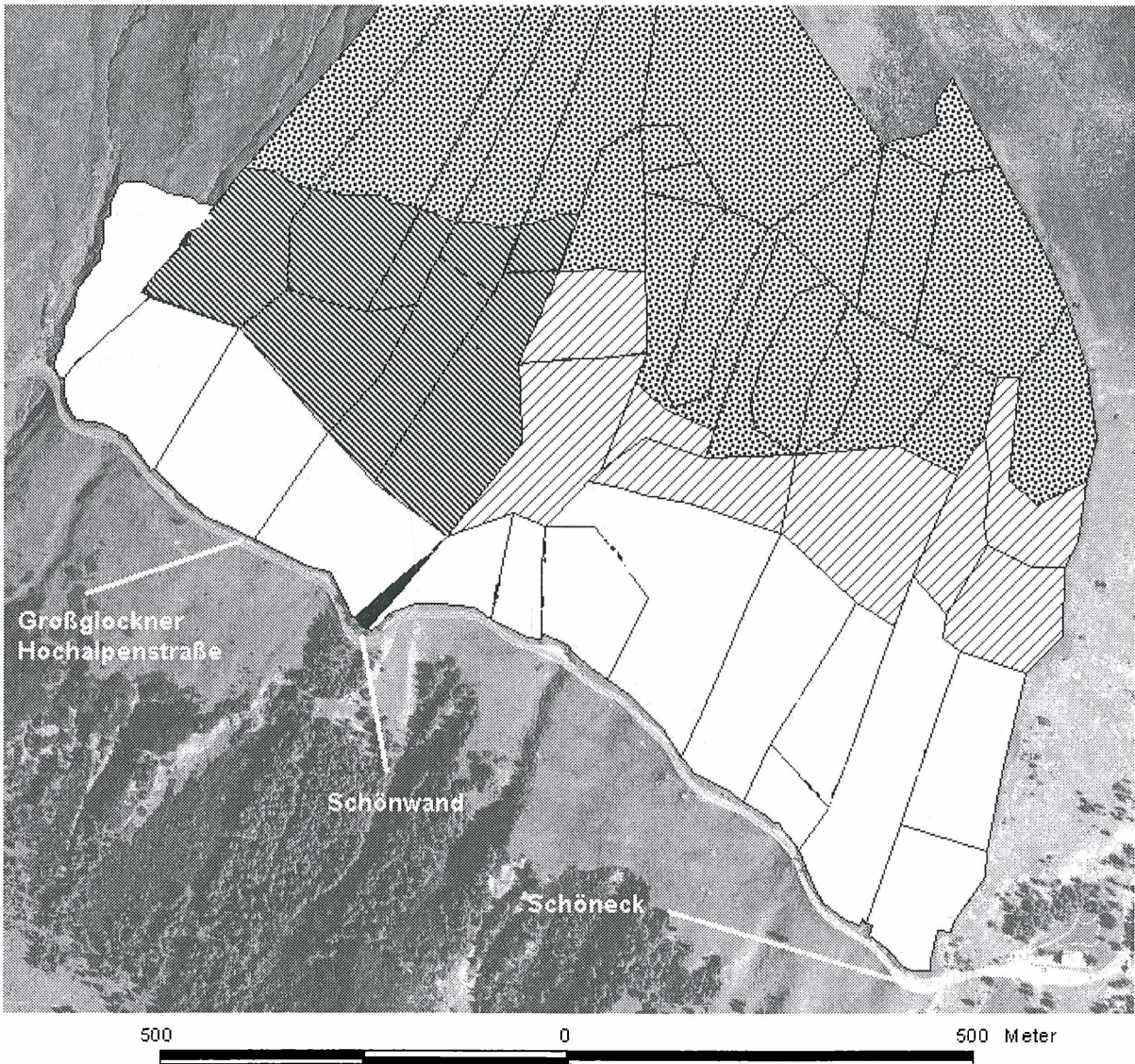


Fig. 2: Maintenance plan for the Pockhorner Wiesen. White zone: continued bi-annual to sporadic mowing. Hatched area: regular mowing alternating with short fallow periods in the middle section. Dotted area: Wilderness area with natural succession.

Source: Digital Orthofoto Nr. 4122.5301, reproduced with the authorization of BEV-Bundesamt für Eich- und Vermessungswesen in Vienna. Cartographie and arrangement: Abl 2004, Kreisch 2005.

Year of project	1	2	3	4	5	6	7	8	9
Year of field evaluation	1		2		3		4		5
Mowing Interval									
Bi-annual	mowing		mowing		mowing		mowing		mowing
Every four years	mowing				mowing				mowing
Every six years	mowing						mowing		
Fallow									-

Tab. 1 Schedule of correlation between mowing patterns and years of field evaluation conducted at bi-annual intervals.

### Discussion

For the monitoring of flower-rich meadow communities, the biodiversity of which is based to a high degree on plant-pollinator relationships, the interdisciplinary biocoenological approach proposed here appears extremely promising. It allows the development of innovative methods for the advanced environmental management of extensively cultivated mountain hay meadows and can in this way help to preserve this endangered landscape. The direct implementation of the monitoring results within an operational maintenance plan guarantees practice-tested results. This management-concept thus provides an effective method for the cultivation and preservation of mountain hay meadows – both within and beyond Hohe Tauern National Park.

In the particular case of the Pockhorner Wiesen, the presentation of the results of our initial research attracted much interest among the local population. This promoted a sense of pride among the owners and users of the meadows, which in turn motivated them to continue or resume mowing and gained them the respect of their communities. This local acceptance is a decisive factor for the conservation of the traditional landscape.

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