

# Does prescribed fire mean a threat to the rare butterfly *Hipparchia fagi*? Larval-habitat preferences give the answer

## Introduction

Within the vineyards of the Kaiserstuhl area, small slopes of traditional vineyard terraces as well as large slopes of land consolidation areas comprise a variety of habitats including dry and semi-dry grasslands (Fig. 1) of high nature conservation relevance. Formerly used for hay-making, these slopes suffer from invasion of woody species and perennial herbs today. To maintain an open meadow-vegetation structure, prescribed fire management in late winter has been reintroduced.

The Kaiserstuhl area, a volcanic mountain remain situated in the southern Upper Rhine Valley, is characterised by exceptional warm and dry climatic conditions due to its geographical position (rain shadow and foehn wind from the Vosges, adjacency to the Belfort Gap).



Fig. 1: Vineyard slopes comprising dry grasslands (brownish; in parts larval habitats of *H. fagi*) and perennial herbs (greenish). (V. Möllenbeck 30.07.2005)

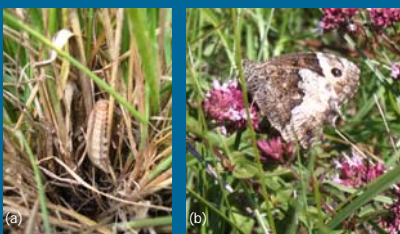


Fig. 2: *H. fagi*, (a) an adult larva retrieved in a *B. erectus*-tuft during daytime, (b) rare observation of a female sucking on flowers (here on *Origanum vulgare*). (V. Möllenbeck 02.05.2007, 09.08.2005)

## Study species

*Hipparchia fagi* (Fig. 2) is a xerothermophilous satyrine species with a Ponto-Mediterranean distribution. The Kaiserstuhl is the last remaining breeding area in Germany and the species' northern range limit. Hibernating as larva in grasslands, the species was assumed to be vulnerable to winter burning.

## Results

The important parameters for larval habitat choice of *H. fagi* are:

- **Microclimate** - Larval habitats are hot due to their south to south-western aspect and the absence of shading shrubs.

- **Vegetation structure** - Sites with sparse plant coverage are preferred by females for egg deposition (Fig. 3, 4) and as habitat by larvae. Larval habitats are characterised by a high proportion of stones or open soil.

Fig. 3: A typical larval habitat of *H. fagi* in Kaiserstuhl vineyard slopes. (V. Möllenbeck 08.05.2005)

Fig. 4: Herb layer coverage at egg deposition sites and random sites. (Mann-Whitney-U-Test \*\*\*  $P < 0.001$ )

- **Host plant structure** - Sturdy grass tufts with high amounts of litter are preferred by larvae (Fig. 5), the same has been documented for ovipositing females.

Fig. 5: Vegetation coverage in different heights at larvae sites and at random sites.

(Mann-Whitney-U-Test \*\*  $P < 0.01$ , \*  $P < 0.05$ , n.s. not significant)

Larval habitat parameters determine the combustibility:

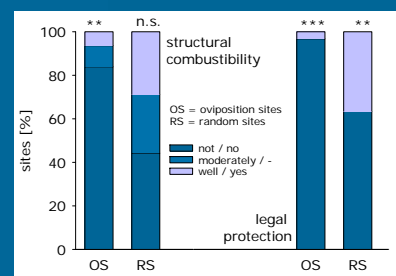
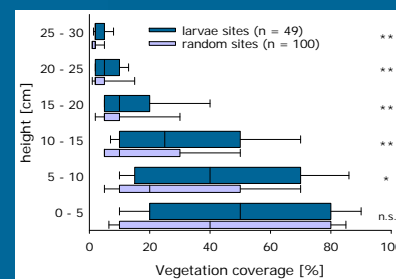
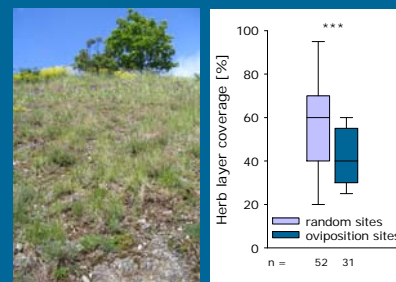
- **Combustibility** - Structural combustibility of larval habitats is low due to sparse vegetation cover. Sites used as larval habitat are mostly legally protected grasslands excluded from fire management (Fig. 6).

Fig. 6: Structural combustibility and legal protection of oviposition sites and random sites.

(Mann-Whitney-U-Test \*\*\*  $P < 0.001$ , \*\*  $P < 0.01$ , \*  $P < 0.05$ , n.s. not significant)

## Methods

Information on microhabitat use gained by i) searching for adult larvae in spring and ii) observation of egg-laying females is compared to the spectrum of available microhabitats. The obtained larval habitat preferences are used to estimate the impact of winter burning on population viability of *H. fagi*.



## Discussion and Conclusions

The open vegetation structure enhances the warm microclimate that is crucial for egg and larval development. The distinct tuft-growth of the host plant *Bromus erectus* provides a suitable habitat for the larvae during hibernation and acts as a secure hide against predation and extreme temperatures during daytime in summer. Vegetation structure also determines combustibility of larval habitats: As larval habitat sites were sparsely vegetated with little available fuel, fire management is not applicable. Thus, burning in winter is not affecting *H. fagi*-populations within the vineyard slopes.