

## Six years from passing bell to recovery: Habitat restoration of the threatened Chequered Blue Butterfly (*Scolitantides orion*) in SE Finland

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We restored the habitat of the vulnerable Chequered Blue Butterfly (*Scolitantides orion* Pallas). The population at the restoration site almost became extinct in the late 1980's due to overgrowth by Scots pine forest. The habitat was restored by selective removal of pines in 1990. The abundance of *S. orion* was estimated in 1990–1996 and 1998–1999, and the population was studied intensively over a short period in 1997. The butterfly recovered after some delay. The numbers of specimens were low during the first five years, but a marked change in 1996–1999 indicated the presence of a persistent population. The habitat restoration most likely prevented the local extinction of *S. orion*.

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### 1. Introduction

Habitat loss is known to be a major threat for many butterfly species. In Finland, 26 of a total of 95 resident species are assessed as being threatened (Rassi *et al.* 1992, Somerma 1997). In addition, 15 other species show signs of decline (Marttila *et al.* 1991). The main reason for the decline of almost all of these 41 species is thought to be habitat destruction (Marttila *et al.* 1991, Rassi *et al.* 1992, Somerma 1997).

The Chequered Blue Butterfly (*Scolitantides orion* Pallas 1771) is a palaeartic species. It is patchily distributed in Central Asia and Russia,

but in Europe it has a fork-like distribution. The southern branch stretches from Russia to South Europe as far as Spain, and the northern one is confined to a narrow zone from Lake Ladoga, through South Fennoscandia and up to Norway in Scandinavia (Higgins & Riley 1973, Heath 1981, Karsholt & Razowski 1996). In Finland, the occurrence of the butterfly has been restricted to local populations on inland ridges in the southern part of the country. The species has always been rare, but during the last 25 years it has clearly declined owing to the loss of suitable habitats caused by natural succession and erosion, constriction and the quarrying of stone. Today

there exist five to ten local populations, but only a couple of these seem to be viable (Marttila *et al.* 1991, Rassi *et al.* 1992, Saarinen 1993, Somerma 1997).

*S. orion* inhabits scattered, open and sunny expanses of bedrock with rich colonies of the larval host plant, Orpine (*Sedum telephium* L.). The pupa overwinters and the adults are on the wing in June, when they repeatedly visit nectar-bearing flowers like strawberries (*Fragaria*), violets (*Viola*), catchflies (*Lychnis*) and some crucifers (*Arabidopsis* spp.) (Marttila *et al.* 1991).

There is quite a long history of habitat management for butterflies in the United States and especially in Britain (Weiss & Murphy 1990, Mattoni 1992), but recently there have been projects also in Finland (Väisänen *et al.* 1994, Blomster 1996, Ormio 1996, Seuranen 1996, Sihvonen 1996, Sundell 1996, Marttila *et al.* 1997). However, the reactions of the species to the management are still largely unknown. Pullin (1996) stated that many attempts have been unsuccessful, due to the unsuitability of the habitat or the lack of knowledge of the species' requirements.

The aim of the habitat restoration was by increasing the suitable habitat of *S. orion* and its food plant to increase the population size of the butterfly to a viable level. The habitat was typically comprised small exposed open expanses of bedrock separated by slopes with quite a lush vegetation, mainly of the *Oxalis acetosella* - *Convallaria majalis* forest site type. In late 1980's, the habitat was rapidly overgrown due to the natural succession, and the population was close to local disappearance.

The history of the population is reasonably well known. Heavy logging was carried out in the area in the 1950's and the terrain was swept by fire in one summer during the early 1960s. The population of the butterfly was discovered in the mid 1960s, but no data on the abundance of the species is available. However, the landscape was then open. In the early 1980s it was still easy to see several individuals daily during the peak flight period, but during the same years the first signs of vegetation succession were observed. Shading by young Scots pines increased rapidly, resulting at the end of the 1980s in markedly decreased butterfly numbers. Only a couple of individuals

were observed annually during the years 1987–1989. The occurrence of Orpine seemed to decrease simultaneously.

It was concluded that without restoration of the habitat, the population would go extinct within the next few years. We report here on the results of the habitat restoration and butterfly monitoring. To our knowledge this was the earliest case of a successful restoration project of a butterfly habitat in Finland.

## 2. Material and methods

The *S. orion* habitat on an island on Lake Saimaa was restored in 1990. The managed area, 280 x 60 m (1.7 hectares) altogether, comprised a total of four separate expanses of bedrock (Fig. 1). Significant areas of the outcrops and their steep edges were heavily occupied by young Scots pines (*Pinus sylvestris*, L.). Selective logging of pines, planned by the first author and accepted by the administration of the South Karelia forestry society and the landowner, the Lutheran Parish of Lappeenranta, was undertaken by Tehdaspuu Co. in April 1990. The forest between the outcrops was also thinned and the logging waste was removed. An open but patchy environment was created (Fig. 1C).

After restoration, in 1990–1996 and 1998–1999 the abundance of *S. orion* was estimated by visits to the habitat during the estimated peak flight time. Two kinds of visits, both of them in good weather conditions were made 1–3 times annually; monitoring period and length of stay in the habitat was 1) up to half an hour during the short period (= *S*) or 2) 2–5 hours during the long period (= *L*). In 1997, the butterflies were monitored by a mark-recapture study over a period of eight days (6.–13.6.). The study area was investigated daily from 9.00–17.00. All butterflies captured were marked individually and released. The daily and total population sizes were estimated by method of Jolly (1965) and Watt *et al.* (1977). No vegetation monitoring studies were made, except the occurrence of the Orpine being followed by qualitative inspections.

## 3. Results

After restoration in 1990, the habitat was an entity of exposed bedrock. In the first years after restoration the habitat was littered with logging waste, but almost all signs of this disappeared by the mid 1990's. The recovery of Orpine was clear. In the late 1980's and early 1990's the patches of the plant were small and looked somewhat suffering, but in the mid 1990's they seemed to be stronger and the plant occurred in larger number

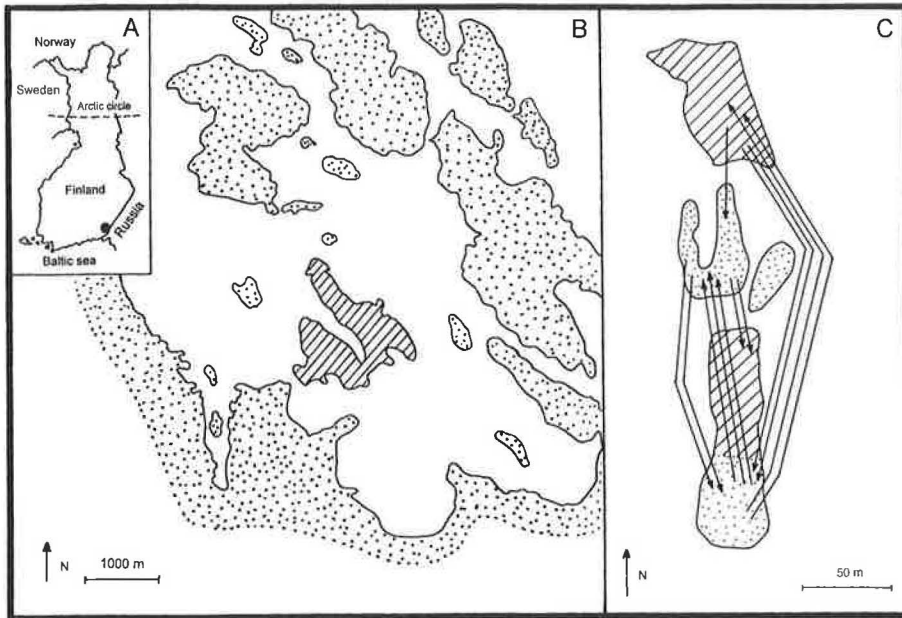


Fig. 1. (A) Location of the study area in Finland (black spot); (B) The home island of *S. orion* in Lake Saimaa (oblique hatching) and (C) the 12 observed movements of the butterflies (arrows) between a total of four in 1990 restored habitat patches during the eight day period (6.-13.6.) in 1997 (spotted area = open rock, area with oblique hatching = semiopen rock).

and covered larger areas.

The numbers of *S. orion* individuals observed in the habitat during the years 1990–1996 and 1998–1999 were 0 (1S), 8 (2L), 10 (2L), 10 (1L), 0 (2S, 1L), 6 (1L), 25 (1L), 8 (1S) and 20 (1L), respectively. In 1997, during the eight day study period a total of 15 males and 8 females were captured, the total number of observations and recaptures being 49 and 26, respectively. Half of the marked males (47 %) and females (50 %) were recaptured on at least one day following the marking. The estimates of daily populations varied in males between 3 and 10.8 and in females between 3 and 5.3 individuals. The estimates of total (9.8 for males, 3.1 for females) population sizes were not reasonable, most probably because of the short monitoring period. The movements of butterflies observed between open habitat patches are presented in Fig. 1C. One specimen was observed 100 m from the habitat on rocky shore of the lake.

## 4. Discussion

### 4.1. Population

In the late 1980's, the population of *S. orion* was close to extinction. The numbers of observed specimens were low from 1990 to 1995, but six years after habitat restoration, in 1996, the numbers increased markedly. In the following three years the population had no signs of return to lower individual numbers. In the same years the trend in another *S. orion* population in south Finland, located 250 km west from the present population, was rather opposite. The annual numbers of eggs of the species were in slight increase between 1991–1995, but in years 1996–1998 the numbers clearly decreased (P. Saarinen, unpubl. data). It is assumed that the weather circumstances have been essentially the same in both locations, and the weather is not the reason for the increase of the

present population.

It is assumed that the population size over the whole flight season was greater than the observed 23 individuals during the study period. In another *S. orion* population, the population was intensively studied during the whole flight season (over six weeks) and estimated population size was 62 individuals (Saarinen 1993). Parallel to this, Henriksen and Kreutzer (1982) stated that individual numbers in many stable *S. orion* populations in Scandinavia have been quite small.

#### 4.2. Future

According to Pullin (1996), successful restoration depends on a detailed study of the ecology and habitat requirements of a species, the ability and the resources to manage the habitat to provide those requirements, and a formal scientific approach that maximises the information gained from the restoration process.

In the present study, the key factors for successful habitat restoration of *S. orion* were present. However, the movements of individuals from one habitat patch to another indicated that the population was neither subdivided nor formed a metapopulation (Hanski & Gilpin 1991, Thomas & Harrison 1992, Nee 1994). Unlike in metapopulations, in the isolated population the rescue effect is not possible (Brown & Kodric-Brown 1977). In addition, recently it has been shown that inbreeding is also one of the most serious threats of small butterfly populations (Saccheri *et al.* 1998).

In the present case, close cooperation with the land owner provided an opportunity to create a network of habitat patches. Firstly, the study island is widely disrupted by similar exposed rock with colonies of Orpine. Secondly, a specimen observed outside the suitable habitat patches indicate a species disposition for dispersal behaviour.

#### 4.3. Conclusive remarks

We conclude that the local population of *S. orion* was rescued by the restoration of the habitat. The recovery of the originally weak population to the present low but typical level took place after some

delay. Close cooperation with land owners, the administrative authorities and naturalists are necessary when using habitat management as a species conservation tool.

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