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Dispersal of common dormice *Muscardinus avellanarius* in a habitat mosaic

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In the eastern part of Saxony (Germany), common dormice *Muscardinus avellanarius* (Linnaeus, 1758) were found in very small woods (average area of 10 woods was 2.9 ± 1.4 ha) isolated within agricultural fields for more than 100 years (average distance to the next, larger wood 268 ± 84 m). Dormice reproduced even in wood islands smaller than two hectares. Altogether 6 marked dormice were recorded migrating across the open landscape. Of these, 5 were juveniles. Minimum and maximum distances in treeless areas between points of capture and recapture were 250 and 500 m respectively. These migrations over open ground seem to be rare but normal events and explain the presence of common dormice in very small patches of woodland in habitat mosaics.

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Introduction

It is known that common dormice *Muscardinus avellanarius* (Linnaeus, 1758) occur at low population densities (Bright and Morris 1990; Juškaitis 2003). Bright *et al.* (1994) have also shown that isolated woods, less than 20 ha in extent, are less likely to support viable dormouse populations. They suggested that fragmentation of woods has been a major factor leading to the local extinction of common dormice. Several questions arise when considering observations of common dormice in isolated small woods, especially since Bright and Morris (1991) found that common dormice are reluctant to cross open ground. British studies showed that common dormice avoid crossing even small gaps in a hedgerow (Bright 1998) and take a longer route through the canopy of trees instead of using a short cut on the ground (Bright and Morris 2005). This was confirmed by Capizzi *et al.* (2002) who concluded that a physical link between woodlots was the most important parameter among the isolation-related factors for the presence of dormice.

In contrast to these results, in Saxony (Germany) common dormice were found in small and completely isolated woods. Occupation of all woods, including the smallest, in the area west of the town of Görlitz by the common dormouse had previously been noted by Herr (1942). Since the 1980s, there are again regular records of common dormice in small woods (H. Ansorge, pers. comm.), each of less than two hectares, and isolated in agricultural fields without any connecting hedgerows or similar structures for more than 100 years. Is there actually an exchange of common dormice between the habitat islands and the neighbouring forest areas and, if so, which individuals are the migrants?

A single case of a dormouse migrating over open ground was recorded in a preliminary study (Büchner 1997). The present study inves-

tigated evidence of common dormice in small woods in Saxony and their dispersal behaviour in a fragmented landscape.

Material and methods

The study was carried out in the eastern part of Saxony (Germany) in a landscape with several woodland mosaics (51°10'N, 14°51'E). Fourteen small woods were surveyed for dormice in 1995 by checking tit nest boxes and in 1996 by searching for gnawed hazelnuts (5 sampling plots of 10 × 10 m in each wood searched for at least 30 minutes) and with 20 hair tubes per ha for 12 weeks, changing the tape and renewing the bait every two weeks (methods described by Bright and Morris 1989, Bright *et al.* 2006).

From the sites with evidence of dormice in 1995, two small woods were chosen for detailed studies. These (study sites A and B) showed typical forest structures for the landscape in eastern Saxony. Both were isolated within agricultural fields that were enclosed by larger woods (Fig. 1).

Site A was about 0.66 ha in extent at a distance of 250 m from the nearest edge of a larger wood (Fig. 1). It was characterized as oak-birch forest (*Quercus petraea* and *Betula pendula*) with a species- rich understorey with mountain ash *Sorbus aucuparia*, European birdcherry *Padus avium*, hazel *Corylus avellana*, blackberry and raspberry (*Rubus fruticosus* and *R. idaeus*).

Site B was 1.25 ha along a little creek, with rich alder-ash and oak wood (*Alnus glutinosa, Fraxinus excelsior, Quercus robur* and *Q. petraea*) and very dense understorey of European birdcherry, elder *Sambucus nigra* and buckthorn *Frangula alnus*. The distance to the next wood was also 250 m (Fig. 1).

The surrounding large forests were mainly Norway spruce *Picea abies* and pine *Pinus sylvestris* plantations, but with well developed and species- rich forests edges. Only site C, an old coppicing area of 4.25 ha, could be described as 'good dormouse habitat', with dense hazel, some old oaks and wild cherry trees *Cerasus avium*. There have been no connecting structures from the patches (A and B) to the next woods for more than 100 years as shown by comparisons with official maps from 1880, 1954 and 1993.

Data were gathered by a mark-recapture study using nest boxes and live traps. Nest boxes were made of wood and the entrance hole faced the tree trunk as recommended by Bright and Morris (1989). At site A 15, at site B 21 nest boxes were put up in grid patterns covering the whole area of the woods. Another grid with 62 boxes was established in the old coppice area (site C). At the edges of the surrounding woods nest boxes were put up in a line (Fig. 1). Distances between nest boxes were 30 m at all sites. Nest boxes (216 in 1996 and 202 in 1997) were inspected at two-weekly intervals from March 20th to November 14th 1996 and March 26th to December 1st 1997.

Dormice were also caught in wooden live traps (20 cm length; 6 cm breadth, 8 cm high) made by DeuFa (Neuburg/Inn Germany) at sites A, B and C. Traps were placed overnight in trees or shrubs at between 1 and 2.5 m above ground during the summer. Altogether 1350 trap nights in 1996 and 305 trap nights in 1997 were analysed. Trap distribution was irregular and not ordered in a grid pattern.

Upon capture, dormice were sexed, weighed and checked for signs of reproduction. Their location was noted and age was estimated where possible. For age estimation from July onwards, unmarked animals below 15 g body mass were

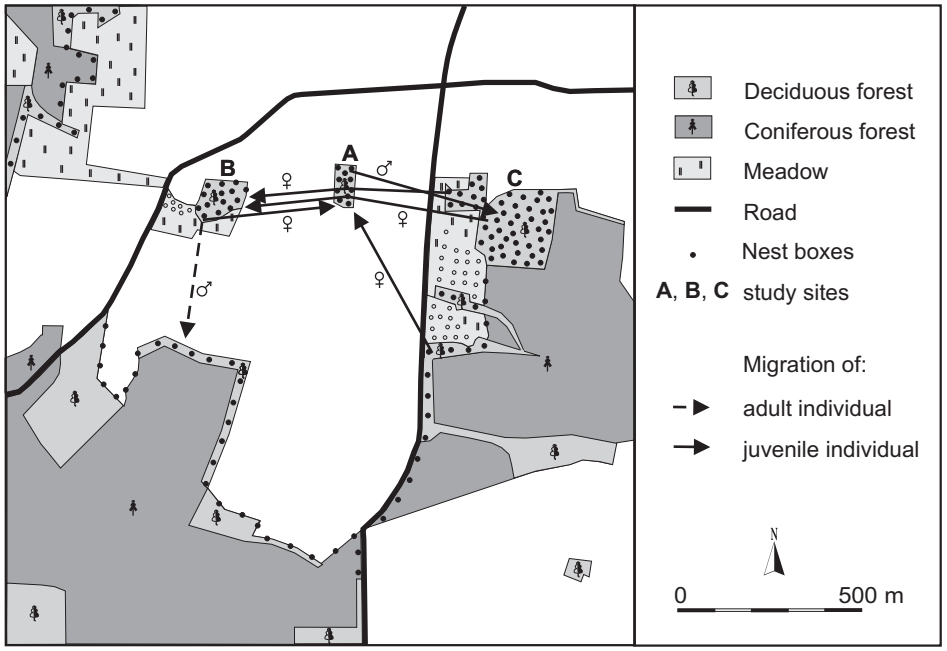

Fig. 1. Movements of marked common dormice between woods over treeless areas in Saxony in 1996 and 1997.

considered as juveniles. Dormice were marked individually by ear tattoos (self made tattoo system using 5 mm numbers from Hauptner & Herberholz, Solingen Germany) and identified if recaptured.

Results

Evidence of common dormice was found in ten of the small woods checked (Table 1). The most isolated wood (area 1.2 ha) containing dormice was situated 450 m away from the nearest forest. The smallest wood plot with dormice was study site A which was 0.66 ha in extent. The largest of the checked woods with no evidence of dormice had an area of 2.1 ha and was situated 350 m away from the nearest forest where evidence of dormice was found.

During the study period 204 individuals were found or trapped and marked individually in the intensively studied area. Altogether 368 captures of dormice were made. In study sites A and B, 34 common dormice were found and marked within the two years. The majority were juveniles (Table 2).

A breeding female was found in each of the woods during the first year. Wood B had two adult females, both with juveniles (litter size 3 and 4) in 1997. Dormice were not found throughout the whole active season. The one female and her litter at site B in 1996 was predated in the nest box, the male left the small wood plot and was recaptured in 1997 in the neighbouring large wood (Fig. 1). Only in autumn did dormice appear again in site B. A similar situation was seen in site A. The farmer was cutting down trees in July 1996, after which no dormice were found there during that summer. In the autumn of 1996 one juvenile dormouse marked at site A was recaptured in site C, and at the same time, dormice recolonized site A.

Table 1. Average area and distance (mean ± SD) of small woods to the next wood with and without evidence of common dormice in Saxony.

Evidence of dormice	Number of woods	Area (ha)	Distance to the next wood (m)
Yes	10	2.9 ± 1.4	268 ± 84
No	4	1.1 ± 0.7	337 ± 89

Table 2. Number of individuals of common dormice in two small woods in Saxony in 1996 and 1997. M – male, F – female.

Site	Year	Number		
		Adult M	Adult F	Juvenile
A	1996	1	1	7
	1997	0	0	5
B	1996	1	1	5
	1997	1	2	10

Table 3. Distances of migration by common dormice crossing open ground in Saxony. M – male, F – female.

Age	Sex	Distance between captures (m)	Distance crossed over open ground (m)
Adult	M	350	350
Juvenile	M	400	250
Juvenile	F	300	250
Juvenile	F	600	250
Juvenile	F	650	500
Juvenile	F	840	500

Evidence of common dormice migrating into another wood by successfully crossing an open field was found once in 1996 and five times in 1997. Animals were emigrating from the small woods as well as immigrating (Fig. 1). The minimum distances of open field crossed between recapture points varied from 250 to 500 m (Table 3). The dormice had to travel through clover and wheat in 1996 and wheat and maize in 1997.

Out of the 6 migrants 5 were juveniles. In addition to these marked individuals, a total of 5 more juvenile dormice, which could not be assigned to a known mother, appeared in the small woods. It must be supposed that at least some of them immigrated from other woods.

Discussion

Common dormice are able to travel quite long distances. Müller-Stiess (pers. comm.) observed maximum distances travelled by common dormice in the forest of more than 7 km in south-west Germany, and Schulze (1987) recorded distances up to 3.3 km in the Harz Mountains (central Germany). Bright *et al.* (1994) hypothesise that dormice might colonize a forest isolated by as

much as 1.5 km in a landscape with woods well connected by hedgerows as likely dispersal corridors. Juškaitis (1997) recorded dormice travelling up to 1.2 km in Lithuania. But all these studies concern distances travelled within woods. Investigations in Great Britain have shown that common dormice are reluctant to cross open ground and remain arboreal for 95% of their activities (Bright and Morris 1991, 1992). The data presented here, however, show that common dormice in Saxony are able to migrate more than 250 m over open ground, this being the only possible explanation for the evidence of common dormice in isolated woods. Opportunities to record movements of common dormice over treeless landscape are very few, but the results from the 14 woods checked in the present study, the observations made in the past in the whole area and the observed movements of 6 individuals indicate that movements over open fields are infrequent but normal behaviour. The data on the dispersers, as well as the distances between recaptures of all marked animals in the study area, also imply that colonizers are mainly juveniles. This is confirmed by Juškaitis (1997) who found that dispersal may be a necessary stage in the life of young common dormice in Lithuania.

However, for the conservation of common dormice these small woods are important step habitats for biotope connectivity. The ability of the species to migrate over comparatively long distances, even over open ground, is crucial for survival in a fragmented landscape since fragmentation seems to be a major factor leading to the extinction of common dormice (Bright *et al.* 1994). But the prerequisites for the survival of common dormice are good habitat structures in the small islands as well as in the larger surrounding woods. Since travelling over open ground is more dangerous for dormice, especially in terms of predation (Bright and Morris 1996), connecting structures such as hedgerows would be helpful in strengthening the population by facilitating safer long-distance movements.

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