

Decayed trees as resting places for Japanese dormouse, *Glirulus japonicus* during the active period

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Decayed trees were surveyed for their role as a resting place for non-hibernating dormice at two sites, at southwest of Mt. Akadake in Yamanashi Prefecture (35°56'N, 138°25'E). A telemeter located three dormice, which frequently used decayed trees in the daytime, with two at more than 50% of the times. The survey also showed decayed trees made up only about one fourth of all trees present in various conditions in habitat forests. These two data indicated that decayed trees are an important resting place for non-hibernating dormice in the daytime and provide favorable environmental conditions for inhabitation.

Using national nut hunt surveys to find protect and raise the profile of hazel dormice throughout their historic range

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The first *Great Nut Hunt* (GNH), launched in 1993 had 6500 participants, identifying 334 new sites and thus confirming the presence of dormice in 29 counties in England and Wales. In 2001, 1200 people found 136 sites with positive signs of hazel dormice. The third GNH started in 2009. Over 4000 people registered and to date almost 460 woodland or hedgerow surveys have been carried out, in conjunction with a systematic survey of 286 woodlands on the Isle of Wight. Of the 460 surveys carried out by the general public, 74 found evidence of dormice.

Many people filled in habitat survey forms, providing information on the type of woodlands and management practices in the woods, which will enable the type of habitat occupied by dormice to be determined.

This paper will present the results from all three surveys, including whether there has been a noticeable change in whether dormice are present at sites and if the percentage of positive results are similar for all three surveys. This paper will look at whether the interest from the general public has declined over the course of the surveys and if people have become more skilled at searching for field signs of the hazel dormouse. An analysis of the habitat data will be presented, looking at the presence of dormice in comparison to different habitat features.

Morphological approach to the genetic variability of the common dormouse *Muscardinus avellanarius*

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The common dormouse is a threatened species all over Europe due to habitat loss as well as woodland fragmentation. Possible consequences such as genetic isolation and „bottle neck“ effects could lead to the loss of genetic variability and developmental stability, followed by a considerable decrease or extinction of this species. To gain more insight into the population genetics of the common dormouse four populations from Bohemia, Germany and Lithuania were investigated. The epigenetic variability within and the epigenetic distance between these populations were studied by using 31 non-metric skull characters. The evaluation of the morphological traits allowed the estimation of genetic relationship. Furthermore non-directional deviations from bilateral symmetry of these traits – fluctuating asymmetry – were used to measure the developmental stability which is influenced by genetic or environmental stress in general. As a first result the epigenetic variability of the common dormouse shows large differences between the single populations. However, the epigenetic variability of the studied common dormouse populations is generally higher than in other rodent species even in the Gliridae. On the other hand the epigenetic variability is lower than in the carnivore species in the same region. The medium epigenetic divergences between the common dormouse populations were generally significant. They seem to be not correlated with geographic distance. The low to medium degree of fluctuating asymmetry differs between the populations. This result corresponds with studies on other rodent species and does not give any special indication of genetic stress. Thus the studied samples of the common dormouse imply to vital populations.

Ski-pistes are ecological barriers to *Glis glis* and other forest small mammals

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Since the beginning of the 20th century, development of ski areas has severely disturbed the environment in the Alps. In particular, the establishment of ski-pistes for downhill skiing impacts these ecosystems across an elevational range montane to alpine habitats. Sky-pistes construction leads to habitat destruction and creates open spaces in otherwise closed forests, with effects on local fauna that are probably similar to other linear barriers or linear clearings. The aim of this research was to study the impacts of forest ski-pistes on small mammals by assessing whether ski-pistes were used or avoided (thus providing evidence of habitat loss), and whether they acted as ecological barriers to local movements.

Fieldwork was carried out in the Sessera Valley (Bielmonte ski-district), north-western Italian Alps (45°40'16½N; 8°05'07½E). Three capture-mark-recapture experiments on core species were carried out to assess habitat use (one experiment) and the capability of crossing ski-pistes (two experiments: spontaneous crossing and individual translocation). Two radiotracking surveys of

the most vagile species, the fat dormouse *Glis glis*, were carried out to locate home ranges and resting sites in relation to ski-pistes.

In the habitat use experiment, a total of 249 small mammals were captured in 2,580 trap nights: 156 *A. flavicollis*, 42 *M. glareolus*, 43 *G. glis*, 5 *M. avellanarius*, and 3 *S. minutus*. With the exception of two *M. glareolus* and two *A. flavicollis*, all other animals were captured outside the ski-piste, suggesting that they are selectively avoided by forest small mammals.

In the spontaneous crossing test, a total of 90 individuals (belonging to *G. glis*, *A. flavicollis*, *M. glareolus*) were trapped in 1,000 trap nights: 44 in beech forest transects, 44 along edges and 2 in the middle of the ski-piste. Marked individuals moved along the same transect in the forest or at the edge, or between the two transects on the same side of the piste, but they never spontaneously crossed the ski run. However, in translocation experiments (that simulated situations in which individuals were highly motivated to cross a barrier), a total of 33 out of 177 (18.6%) small mammals translocated to the other side of the ski-piste (return rate: *G. glis* 36.7%, *M. glareolus* 20.0%, *A. flavicollis* 14.7%), were able to cross the ski-piste and come back to the original forest patch.

Thirteen radiotracked *G. glis* maintained home ranges on one side of the ski piste and they never crossed it. Resting sites (N = 18) were mostly underground, between rocks, boulders and in rocky crevices, never in the ski-piste.

Our study clearly suggests that the interruption in the continuity of the forest cover caused by ski-pistes can severely affect the ecology of small mammals in two ways. First, these anthropogenic linear open habitat elements are usually avoided by forest small mammals, thus representing a typical case of habitat loss to this fauna. Second, forest ski-pistes may also act as ecological barriers that partially or totally prevent individuals from moving between adjacent forest patches. To mitigate habitat loss and make movements between forest patches easier, a possible management intervention could be maintaining a partial shrub cover or adding woody debris, both relatively easy methods for ski areas to implement in order to maintain small mammal communities.

Dispersal since reintroduction and movement of individual animals between nest boxes of *Muscardinus avellanarius*

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This study, based on data collected by the Northwest Dormouse Partnership, looks at a reintroduced population of hazel dormouse, *Muscardinus avellanarius*, in Cheshire. Dispersal movements from the points of initial release throughout the reintroduction site are analysed in relation to environmental factors such as weather, seasonal variations and food availability

The movement of individual animals has also been analysed, building on a preliminary analysis of the data through the use of micro-chip and GIS technology. This has allowed the plotting of movement between nest boxes and estimates of home range size. Further to this, it has been possible to assess the fidelity of individual animals to their home range, in some cases over a period of several years. Further comparisons are also made between sexes, as well as between adults and juveniles.

A comparison of demographic statistics between two populations of *Muscardinus avellanarius*, in the north of its UK range

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Mark and recapture monitoring of *Muscardinus avellanarius* at two sites has been carried out by the Northwest Dormouse Partnership since 2005. The sites are:

1. Wych Valley, Cheshire: a semi-natural ancient clough woodland of approximately 30ha, where dormice were released in 1996/97, as part of the English Nature Species Recovery Programme.
2. Bontuchel, Denbighshire: a planted ancient woodland site of approximately 75ha that is now managed to restore native woodland. A wild population was discovered in the 1990s when dormouse nests were found in bird boxes.

With over 800 animals marked in 6 years, and 34% recaptured, this is one of the largest studies of this type to have been carried out with this species in the UK. Population statistics are compared between study sites giving a unique insight into the demographics of a natural dormouse population in the UK, and comparison with a released population in the same region. Observed differences are discussed in relation to performance of reintroduced populations of this species in the UK.

The present status of the Garden dormouse (*Eliomys quercinus*) in Western Germany

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Although Germany has a special conservation responsibility for the garden dormouse (*Eliomys quercinus*) there exist nearly no systematically monitored data on its present conservation status for large regions of the species' range in Germany. Mostly only data of records achieved by accident are available. The garden dormouse is not a species of interest for nature conservation. Even people engaged in local nature conservation in areas, where the species was found formerly; start to realize they made no observations for many years when asked for records.

When data of the present spreading of the garden dormouse are compared to findings from before 1990 in Western Germany the species seems to melt away, as it is the case in many other regions of its former range. Especially populations on the border of the species range seem to have disappeared. Because this European endemic is not especially protected by European law no energy and money is invested up to know in monitoring programmes to clear its present range, abundance and possible threats and as a consequence of that, no conservation measures or programmes are implemented.

New findings of the genus *Altomiramys* (Mammalia, Gliridae) in the Lower Miocene (Agenian and Aragonian) of the Ebro and Ribesalbes-Alcora Basins (Spain)

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Altomiramys (Myomiminae) is a very uncommon glirid in the rodent assemblages from the Lower Miocene (Agenian; MN1-MN2, 23.0-20 Ma) of the Iberian Peninsula. So far, only one species (*Altomiramys daamsi*) has been described in the fossiliferous levels of Loranca (Agenian, upper part of MN2, 20 Ma) and Ramblar 1 (Lower Ramblian, MN3, 19.4-19.9 Ma). Daams (1989, 1999) mentioned the presence of an unpublished second species of *Altomiramys* in Cetina de Aragón (lower part of Early Miocene, MN1), older than the previous localities where the genus is reported. Therefore, the fossil record of this genus comprises the time span between MN1 and MN3. The remains of *Altomiramys* are extremely scarce in the paleontological record; only one specimen in its type locality (Loranca) and ten specimens in Ramblar 1. New material of this genus has been found in the locality of Cuesta Agujeros-2 (Ebro Basin) and Mas de Antolino B-5 (Ribesalbes-Alcora Basin). In Cuesta Agujeros 2, the association of *Altomiramys*, *Peridymys turbatus* and *Simplomys* aff. *aljaphi* is typical from the Agenian (upper part of MN2, 19.9 Ma), while the occurrence of *Megacricetodon primitivus* and *Ligerimys ellipticus* at Mas de Antolino B-5 is consistent with an Aragonian age (MN4, 16.6-16 Ma).

Reintroduction of the edible dormouse *Glis glis* to forests of north-western Poland

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The edible dormouse has nearly become extinct in central and north-western Poland. Its extinction could be due to very extensive deforestation in the past.

To restore the species in the north-western part of the country, a three reintroduction programmes were undertaken: in Sierakowski Landscape Park (SLP), in Szczeciński LP (SzLP) and in Gorzowsko-Barlinecki LP (G-BLP). In SLP animals were released in the years 1998-2002 and in SzLP between 2003 and 2006. In G-BLP first group of dormice will be released in 2011. Now we try to find - on the basis of genetic research - the best source population for reintroduction in G-BLP. It was found that in SLP the size of the population and the area it occupied considerable increased since the year 2002. In SzLP evaluation of a reintroduction started last year. It was found that edible dormouse still occupies the nature reserves of SzLP (where they were released) but no quantitative data were collected.

Project of reintroduction in G-BLP and evaluation researches in two other parks were supported by 1) European Union: Europejski Fundusz Rozwoju Regionalnego, Program Operacyjny Infrastruktura i Środowisko and 2) Narodowy Fundusz Ochrony Środowiska i Gospodarki Wodnej.

Biology and ecology of common dormouse *Muscardinus avellanarius* in Promno Landscape Park (Poland) – preliminary results

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Although common dormouse is a protected species, in Poland it has been poorly studied so far. Only general data concerning distribution in the country, breeding and habitats occupied by common dormouse are available.

In Promno Landscape Park (PLP), one of a few localities of the species in central and north-western part of Poland, studies on biology and ecology of common dormouse were conducted in years 2004-2006 and 2009-2010. Data on distribution of common dormouse within the park, nest sites, habitat preferences and population parameters were collected using methods such as: searching of gnawed hazelnuts and nests, regular controls of nestboxes and nest tubes.

Common dormouse were found in 27 forest compartments representing wide range of forest habitats such as deciduous and mixed stands, hazel shrubs, forest clearings. Animals tend to prefer areas of dense and species-rich understorey. All nests found in PLP, were placed up to the height of 1,5 m. Seven out of twelve nests were situated in pine and oak regenerations. Mean population density of common dormouse in PLP was 0,9 ind./ha. This parameter varied between years and study plots. Mean litter size was 3,78 juveniles per female.

The importance of hedgerows for hazel dormice (*Muscardinus avellanarius*) in Northern Germany

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The existence of hazel dormice in Schleswig-Holstein, the country with the lowest proportion of forest area in Germany (10%), mainly depends on the hedgerow-network as dispersal corridors and suitable habitats.

Therefore, the identification of relationships between structural properties of hedgerows in addition to the surrounding landscape and the presence of dormice, was the main aim of my thesis in 2008/2009.

A Total of 715 nest tubes hung from June till November in five study areas of different landscape structure. I also searched for natural nests (= hanging in bushes, not built in tubes). Newly built dormouse nests were detected during the entire study period in the nest tubes. The maximum number of new occupancies took place in October.

There were between 0.1 to 2.0 natural nests and 1.2 to 5.5 nests per nest tube at 100 m searching distance across all dormice-populated hedgerows.

The assumed habitat suitability of the five study areas of different landscape structure (depending on hedgerow occurrence and nearby forest areas) was reflected in the number of registered dormouse nests:

the most dormouse nests were detected in areas with a (very) high hypothetical habitat suitability (1.03 and 0.39 to 100 m searching distance), the mean number of nests in sites with medium habitat quality (0.18 nests per 100 m searching distance) and the fewest evidence were recorded in the two areas of the lowest assumed dormouse suitability (0.14 and 0.11 nests per 100 m searching

distance), which were also built quite late in the year.

Within 2 study areas, a relatively high number of dormouse nests were detected in about half of the investigated hedgerows and unmistakable reproduction nests – also within nest tubes (!) – were also found. As a result of this, the hazel dormouse use hedgerows throughout the growing season and even establish permanent populations in them (when sufficient shrub diversity is given).

To investigate the habitat requirements of dormice, several parameters were analyzed. However, only the number of woody plants showed a significant correlation with dormouse occurrence: dormice seem to use only hedgerows as a habitat, if they have at least 12 different woody species (including trees).

Beside this it seems that the proportion of existing woods and the qualities of the hedgerows within a surrounding area of 500 m have a great impact on local hazel dormice populations.

Furthermore, during the study period more than half of the natural nests were registered in blackthorn (*Prunus spinosa*; 54%), followed by blackberry (*Rubus fruticosus agg.*). Three nests were also within hawthorn (*Crataegus spec.*) and each one inside poplar (*Populus spec.*) and reed (*Phragmites spec.*).

Translocation of hazel dormice in 2009

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In autumn 2009, nine adult dormice were translocated by hard release (without pre-release cages) within nest tubes from the slopes of the main road into the compensation area, where many nest boxes were installed before – when several dormice were within a tube, the group was not separated. Eight days after the translocation two hazel dormice from different “release-tubes” could be recovered within one tube.

In May 2010, a translocated hazel dormouse could be recovered within a nest box - therefore at least one of the translocated dormice survived stress and hibernation.

This early detection, however, remained the only recapture. So it is important to mention that it's most probable that the soft-release method, as recommended by several experts, would have provided a much higher survival rate in contrast to the used hard-release method.

„Non-typical“ habitats of hazel dormice in Germany

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More and more dormice occurrences in Germany could be found with time in sites which seem to be unsuitable at first glance: for example is there an increasing number of dormouse evidence directly on roadsides and even in small-scale scrubs, which are completely surrounded by roads.

In autumn 2008 we found 60 dormice nests within small patches which were included by a motorway and a main road in North Germany. In the following years we've found numerous nests each time at this place. During the construction of the roads the total tree- and shrub-vegetation

had been removed, so it seems to be certain that the dormice resettled these sites many years after the end of the construction activities.

Searching for dormice in other parts of Germany in similar places showed similar results.

The necessary crossings of roads and the type, quality, and size of the sites lead to further questions about the impact of roadside areas as possible source habitats for dispersal and resettlement processes, about the barrier effect of roads and the expected traffic mortality.

The Effects of forest management and habitat quality on the fertility of the Hazel Dormouse (*Muscardinus Avellanarius*)

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In rural landscapes woodlands are constantly managed for timber production. The type of management may determine the quality of habitat, (e.g. availability of resources): therefore studying how different management strategies influence the fitness of a population is an important conservation issue. In this study we investigated the relationships between the type of forest management and the fecundity of the hazel dormouse (*Muscardinus avellanarius*). The research was carried out in a continuous forest block sized about 2500 ha where we placed a total of eight square grids (36 nest-boxes in each one) in three differently managed areas: old-growth, old coppice and regrowing stands. Nestboxes were inspected each month April 2010 to November 2010. In order to describe the vegetation structure of the study area, we gathered data on several parameters describing the arboreal and shrub layers. We recorded an increasing mean brood size from older to younger stands. Mean brood size was positively correlated with shrub species richness and density of the shrub layer. Our results suggest that management of the shrub layer could enhance the fitness at a local scale, and, we hypothesize, the potential role of source-habitat on a broader context.

Behavioural and physiological consequences of reproductive activity in male edible dormice (*Glis glis*)

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Testosterone mediates male reproductive trade-offs in vertebrates including mammals. In male edible dormice (*Glis glis*), high levels of testosterone reduce their ability to enter torpor, which dramatically increases thermoregulatory costs. Aims of this study were therefore to analyse behavioural and physiological consequences of reproductive activity in male edible dormice under

ecologically and evolutionary relevant conditions in the field. We analysed body mass development and oxygen consumption and integrated these findings into a capture / recapture study in the field.

Our results revealed that in reproductive as in non-reproductive males the number of individuals huddling together was negatively influenced by their body mass. However, in reproductive males group size was further negatively affected by ambient temperature and positively by testes size. Thus breeders formed larger sleeping groups at lower ambient temperatures and males with larger testes were found in larger groups than males with smaller testes. Measurements of oxygen consumption further demonstrated that grouping behaviour represents an efficient strategy to reduce energy expenditure in edible dormice as it reduced energy requirements by almost 40%. In summary, results of this field study showcase how sexually active male edible dormice may, through behavioural adjustment, counterbalance high thermoregulatory costs associated with reproductive activity.

Timing of nocturnal activity in the edible dormouse: seasonal patterns and influential factors

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In mammals the timing of nocturnal activity is influenced by a variety of factors. The essential problem of most studies is the fact that they were not conducted under fully natural settings and those few ones that were carried out on wild animals were done over a relatively short time period. We used non-invasive automatic monitoring devices to study the seasonal patterns of timing of nocturnal activity in an arboreal cavity-dwelling rodent, the edible dormouse. During three years we obtained 1,167 records on 102 individuals of their timing of evening emergence and morning immergence from nest boxes which they regularly use as daytime denning sites. We found that the activity patterns were best explained by the seasonal progress of photoperiod, followed by much weaker effects of cloud cover and sexual activity. With increasing cloud cover the dormice emerged earlier and immersed later from their nest boxes. Sexual activity had a distinct sex-specific pattern during the summer season. During the mating period in July, sexually active males emerged earlier from their nest boxes than females or sexually quiescent individuals. But this pattern changed latter in August when lactating females substantially prolonged their night-time activity period and they were among the first to emerge from the nest boxes and among the last ones to immerge into them before the sunrise.

The Use of Natural Shelters by Three Dormouse Species in the Transylvanian Plateau (Romania)

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In the years 2008, 2009 and 2010 we observed the way three dormouse species in the plateau woods were using their natural shelters. We chose to use on-site survey and we subsequently marked on the map the shelters we found by means of a GIS system. This further allowed us to annually check each stable shelter (hollow). When processing the data we found out that in the following habitats : 91IO* Euro- Siberian steppe-type woods with *Quercus* spp. and 91YO* Dacian oak & hornbeam forests, which prevail in the west of the plateau, all the three dormouse species

reported in Transylvania are living, i.e. *Muscardinus avellanarius*, *Dryomys nitedula* and *Glis glis*. Less frequent is *Dryomys nitedula*, which has never been reported in the eastern beech forests.

In summer, *Glis glis* mostly uses the hollows in certain tree species, and so does *Dryomys nitedula*. We even noticed a sort of competition between the two species in trying to settle in those shelters. Notes were taken of the following: the height of the tree-hollow from the ground, the tree species, the tree diameter, whether the animal was there or not, the type of gallery, i.e. vertical or slanted, to what extent the tree was rotten, as well as the tree location as reported to the edge of the forest or to the nearby clearings. Occasionally, large dormice were found in the nests located on the branch joints.

Muscardinus avellanarius also uses the tree-hollows, by arranging its shelters as round-shaped nests. Several aspects were also investigated concerning the shelter location and the manner and the materials used for building them. This analysis was also made for *Dryomys nitedula*, which but seldom builds its nests on the trees.

Body temperature pattern and microhabitat use in the overwintering Japanese dormouse (*Glirulus Japonicus*)

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Winter ecology of Japanese dormice (*Glirulus japonicus*), endemic species in Japan is not known well. Thus, we investigated body temperature patterns of captive dormice kept under semi-natural conditions and also radio tracked the free-ranging dormouse before, during and after hibernation. Core body temperature was monitored every 3 hours from October to May in a total of 8 animals. They were kept in outdoor cages placed on the forest floor. Water and food were supplied ad lib throughout investigation and food consumption was checked every day.

Prior to onset of hibernation, animals exhibited daily torpor frequently and then entered hibernation. During hibernation period, dormice aroused periodically but never foraged during arousal. Torpor bout duration tended to be shorter around the beginning and the termination of hibernation period while consistently longer during mid-period of hibernation. Frequent changes occurred in body temperature just before the termination of hibernation.

On the other hand, the free-ranging dormouse hibernated by itself and built subterranean hibernaculum at a depth of 3 to 5cm. The dormouse stayed at the same place, and did not move around during the winter. These findings in the Japanese dormouse are in good accordance with those in other dormouse species in Europe.

Hedgerows for Dormice: improving connectivity in the landscape

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In 2009 People's Trust for Endangered Species started an initiative called Hedgerows for Dormice aimed at boosting hazel dormouse habitat and increasing connectivity between isolated woodland sites by improving the condition of hedgerows.

Essentially inhabitants of woodland edge habitat, dormice are known to also utilise hedgerows for feeding, breeding, hibernating and dispersal. However, dormice numbers in hedgerows have fallen by 64% since the 1970s, probably as a result of the decline in hedgerow extent and management, especially the traditional skill of hedge-laying.

Hedgerow loss virtually halved since the 1940s and whilst losses are now being balanced by new planting, evidence suggests that lack of or inappropriate hedgerow management means that only 22% are in "good condition".

Hedgerows for Dormice aimed to increase connectivity and habitat by creating hedgerow 'highways' between dormice woodland sites. We mapped hedgerows in dormouse 'record hotspots' and where hedgerows had been removed or were not in good condition, we have been working with local partners to offer advice on management and coordinating conservation volunteers to gap-up hedges by planting, laying and coppicing.

Hedgerows for Dormice has now come to the end of its grant, having planted nearly 10km of hedgerow. Here we identify its achievements and outline possible directions for the future.

Influence of edible dormouse *Glis glis* on arboreal activity of yellow-necked mouse *Apodemus flavicollis* and bank vole *Myodes glareolus*

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Yellow-necked mouse as well as bank vole, are capable of climbing trees and bushes. In some woods they can meet arboreal species – edible dormouse. Anecdotal reports suggest that edible dormouse might be aggressive towards smaller rodent species.

The aim of our study was to determine whether the presence of edible dormouse will reduce number of *A. flavicollis* and *M. glareolus* which climb on trees and bushes.

Research was conducted in Sierakowski Landscape Park in years 2007-2008 on three study plots: 1 – where dormice were constantly active, 2 – where they occurred occasionally, and 3 – where dormice were absent. Animals were caught in traps located on the ground-level (first 5 days) and fixed to bush and tree branches (next 5 days). Studies were made when edible dormouse was active as well as when it hibernated, accordingly in August and October.

In August there were significant differences in trappability of yellow-necked mouse and bank vole in traps fixed to branches, between the study plots with dormice (1 and 2) and without them (3). In October no such differences were found.

Results obtained during these studies suggest that edible dormouse limits arboreal activity of yellow-necked mouse and bank vole.

Why common dormice are common in Lithuania?

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Common dormouse is a threatened species in many European countries, but not in Lithuania, where it is widespread and common. According to expert evaluation, the total dormouse population in Lithuania should be minimum 1,000,000 adults. Main reasons of such dormouse status in Lithuania are:

- Common dormice have plenty of habitats, although these are far from optimal habitats described for this species.

- Dormice do not need specialised habitats as was proposed earlier. They are adapted to live in habitats with low diversity of food plants and unpredictable crops of these plants in different years.
- Dormouse populations keep stable abundance in ordinary commercial forests. Forest management operations used in Lithuania, first of clear-felling, are favourable for common dormice with some temporary negative influence.
- In general, the Lithuanian forest management system has been favourable for common dormice.

Long-term population studies are continued and dormouse diet as well as habitat requirements in typical sub-optimal Lithuanian habitats are investigated in the project "Peculiarities of dormouse (Gliridae) populations on the north-western periphery of their distributional ranges" (No VP1-3.1-SMM-07-K-01-026) funded by the Research Council of Lithuania.

The edible dormouse (*Glis glis*) in Lithuania – outside distribution range of the beech (*Fagus sylvatica*)

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Lithuania is situated outside the range of the beech, which is a key tree species for the edible dormouse in central parts of its range. In Lithuania, edible dormouse is included in the Red data book and in the list of strictly protected species. Only ten populations of this species are known at present. Initial studies have shown some peculiarities of the edible dormouse ecology in Lithuania compared with central parts of the range. In Lithuania, typical habitats for this species are mature mixed forests with old oak trees, coniferous trees (Norway spruce and Scotch pine) and hazel. Dormouse activity season lasts from late May until early October. Share of animal food is possibly increased in spring, oak acorns and hazel nuts are the main food sources in autumn. Body weight of adults before hibernation is typically less than 150 g (maximum 197 g). Skips of reproduction are possible in years when crop of oak and hazel is scarce or absent. Abundance dynamics is comparatively stable, without pronounced peaks; restoration of decreased abundance lasted for several years. Dormouse diet and population parameters are investigated in typical Lithuanian habitat in the project (No VP1-3.1-SMM-07-K-01-026) funded by the Research Council of Lithuania.

Does the occurrence of the Common Dormouse *Muscardinus avellanarius* in East-Saxony (Germany) dependent on habitat isolation and size?

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In the eastern part of Saxony common dormice were found in small and isolated woods. Previous studies in selected small woods could show that dormice are able to cross open ground to migrate in or out of these woods. The scope of the here presented study was to determine the incidence of dormice in relation to isolation and size of the sites on a larger scale. For this 56 sites were checked for the occurrence of dormice in an area of approx. 330 km². The results show that dormice are more likely to be present in woods larger than 20 ha. This implicates a minimum habitat size of 20 ha for viable populations. It seems further that up to 20 m no effect of habitat isolation exists

because dormice were present in wood lots smaller than 20 ha when the distance to the next wood with dormice was lesser than 20 m. In contrast to this dormice could be observed in single cases in very small and isolated patches, too. One of the most isolated woods with dormice was only 2 ha in extend and in a distance of 669 m to the next wood.

Biodiversity in cross-boarder corridors (BioGrenzKorr): An international project on management of corridors for hazel dormice

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Biodiversity in cross-boarder corridors (BioGrenzKorr) is a new EU-INTERREG 4A project across the Danish-German boarder. Corridors play a vital role for the spread of species in a strongly fragmented landscape. The main project objective is to create awareness on corridors in the matrix between woodlands and small habitats in the open landscape but also to safeguard a small hazel dormouse population on the Danish side of the boarder. Project areas have been selected in order to connect hazel dormouse habitats. The target is a cross-boarder corridor between the Danish hazel dormouse population and a new re-introduced German population. German re-introduction, based on Danish animals, is part of the project (a mirror population).

The project develops methods for habitat improvements and management of hedgerows taking the requirements of hazel dormouse and landowners into account. This is done through networking and sharing of knowledge across the border and by testing methods in the field. Results are disseminated as recommendations for farmers, forest managers and contractors and will put focus upon hedgerows as a resource that requires proper management and as an underestimated element in nature conservation.

Patterns of sleep communities of the Edible Dormouse (*Glis glis*) during the active season

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Key words: edible dormouse, sleep communities, nest boxes, individual marking

The data used for this study were obtained from a mark-and recapture project monitoring the population biology of the Edible Dormouse. From 2002 to 2008 all dormice found in nest boxes were captured and marked with passive transponders and monitored from April to late autumn carrying out daily checks using a scanner to minimize disturbance. The project was conducted in two sample areas near the town of Schluechtern, 70km north-east of Frankfurt am Main, Germany. They consist of 279 nest boxes spread over a total of 16.2 ha in mixed deciduous woodland.

The study focuses on the sleep communities which show very different patterns regarding age, sex and number of sleeping mates depending on the period of the active season as well as on whether dormice go into reproduction or not.

Edible dormice on the Mediterranean island of Cres

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The edible dormouse, *Glis glis* was reported from 19 islands in the Mediterranean and Baltic seas. In the Adriatic land bridge archipelago, the animal occupies only the larger islands (surface area of 100–410 km²). The distributional pattern fits into the nested matrix of the archipelago, therefore the absence of dormouse from the smaller islands possibly points to predictable extinctions with no subsequent recolonizations. Island populations are smaller (length of head and body in a sample from the island of Brač = 168.1 mm ±9.14, N = 32) than those occupying continental mountain forest along the coast (187.0 mm ±9.63, N = 43). Nowadays the edible dormice is hunted and consumed on several islands, which may somewhat influence the existing populations. Anecdotal information suggests that the ecology of insular population may be very different from the one in mainland populations. E.g. the edible dormouse is active also in December and January in the evergreen forests and shrubs in the islands while starts hibernating between September and October in the mainland. Presence of scrotal males in September and accumulation of fat reserves already in summer also point to a different life cycle as compared in the mainland. To assess the biology of insular populations, we initiated a CR study on the northern Adriatic Island of Cres. Eighty nest-boxes were set in an oak forest in April 2011. Preliminary results are reported.

Dormice in a mixed southern European forest

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Dormice are mainly studied apart from mice and voles, which are believed to be the major small mammal consumers in deciduous forest ecosystems in Europe. Contrary to r-selected mice and vole, the dormice are relatively K-selected and are believed to be rare throughout their range. We studied assemblage of terrestrial small mammals in mixed fir and beech forests at about 1200 m of elevation in southwestern Slovenia. Trapping was performed between 2008 and 2010 twice per year (spring and autumn), on 40 sampling plots. Each plot was equipped with 12 traps on the ground level and 4 traps on trees c. 5 m high. In total 9600 trap nights yielded three species of dormice (*Glis glis*, *Dryomys nitedula*, *Muscardinus avellanarius*), one mouse (*Apodemus flavicollis*), one vole (*Clethrionomys glareolu*) and three shrews. With 703 individuals (=70% of all small mammals trapped) mice and voles were more abundant than dormice (101 individuals; 10%), but the discrepancy was much less in total biomass (kg): 16.7 in muroids versus 9.4 in dormice. Majority of dormice (91%) were trapped on trees and the bulk of voles and mice (97%) were captured on the ground.

The influence of handling on the denning activity in the edible dormouse

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The knowledge how animals respond to investigators' disturbance, when standard practice includes their catching, measuring or marking, is of critical importance for a fair assessment of presence of any form of bias in routinely used research protocols. Equally important, it is an essential prerequisite for anyone interested not only in collected data but also in animal welfare and ethically sounded research. Here we take an advantage of an automatic logging system for monitoring the nest box use activity of PIT-tagged edible dormice after standard handling procedures applied by us during a regular nest box monitoring programme. We assessed the potential disturbance on dormice in two ways a) whether it affected the decision of the animal to stay in the same nest box for another day, b) whether it affected the timing of the animal's nocturnal emergence from the nest boxes. We also evaluated the effects of season, age, sex, sexual activity and type of manipulation (extensive handling vs. a brief nest box check without handling the animals). We detected that non-manipulated animals, females and sexually active animals spent a following day in the nest box with much higher probability than those who were extensively handled. In contrast, the manipulation with dormice did not have a significant impact on the timing of the nocturnal emergence from nest boxes.

Spatiotemporal survival patterns of edible dormice (*Glis glis*) across Europe

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It has been shown previously that in edible dormice reproduction clearly affects their survival to the subsequent year. However, the actual causes for this impaired survival remained unclear. In this study we compared the spatiotemporal variation of survival rates in five populations of edible dormice at distant sites in Europe, as determining the patterns of survival rates can provide insights into possible causes of mortality.

We found very high survival rates during winter, which indicates that edible dormice do not starve due to insufficient energy reserves during the hibernation period. Increased mortality found in early summer was most likely caused by a high predation risk and high energetic demands. As expected, survival was always lower in reproductive years than in non-reproductive years. Also, recapture probabilities indicated that dormice were more active in reproductive years, which probably increased predation risk and enhanced the effects of high energetic demands on mortality. Females always had higher survival rates than males. Although similar temporal patterns could be found in all areas, there were also considerable differences in average survival rates, which were most likely due to differences in predation pressure. Variation in survival rates resulted in differences in mean lifetime reproductive success between populations.

The glirid faunas from Gormaget area (Alcoi basin, Spain): a case of the impoverished dormice assemblages of the Pliocene

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The low extant diversity of dormice in Europe contrasts with the 23 extinct genera registered in the Miocene (23-5.3 Ma), reaching the maximum in the Early Miocene (16.5 Ma). A strong reduction of diversity came with the immigration of the modern cricetids (16 Ma). The entry of these faunas coincided with a dramatic reduction in both number of species and relative abundance of the glirids in the rodent assemblages of Europe. This trend went on until the beginning of upper Miocene (11 Ma), when their relative abundance suffered a considerable rise. The scenario remained the same for about a million years until the MN9-MN10 transition (Vallesian, 9.8 Ma), when the murids arrived in Europe. From this time forward, a minimum of diversity was reached, with only eight surviving genera in the continent after the Messinian crisis around the Miocene-Pliocene boundary (5.3 Ma). A more extreme case is found in the Iberian Peninsula, where just two genera (*Eliomys* and *Muscardinus*) are common in the Upper Miocene and Pliocene rodent assemblages. This situation is clearly represented in the localities from the Pliocene of Alcoi (Eastern of Spain), where the glirids became extremely scarce, with the exclusive presence of two species of the genus *Eliomys*.

Femoral osteometry of the Fat dormouse (*Glis glis*): anatomic basis for the examination of population differentiation

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Osteometric features of the femur in adult males and females, as well as in semi-adult males of Fat dormouse (*Glis glis*) have been evaluated. Seven morphometric characters of femoral anatomy and its angular configuration have been measured on electronic pictures of cadaveric femora without any developmental bone abnormality. In addition to the femoral osteometry of the Fat dormouse, 12 indexes have been calculated from the linear measurements. The examination and statistical analysis of defined femoral features have established a primary norm of its variation of the male and female *Glis glis*. Obtained results indicated that femoral osteometric measurements of Fat dormouse allow identifying the sex and the age of the studied specimens; moreover, as femoral osteometric measurements are likely to be affected by population variations in heredity and geographical factors related to life style, the femur structure can be analyzed and interpreted in order to reveal interpopulation differences in this species.

Key words: Fat dormouse, *Glis glis*, Femur, osteometric measurements

Fat dormouse (*Glis glis*) as an accumulative bioindicator of heavy metal bioavailability in agricultural region in Bulgaria

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Determination of zoomonitor characteristics of the Fat dormouse (*Glis glis*) in regard to its usage for bioindication of heavy metal contamination in the environment was provoked by the increased human activity in wild animals' habitats in North-eastern Bulgaria.

The heavy metals residuals ($X \pm SD$ mg/kg dry weight) of elements with concentration dependant toxic effect (Cu $23,865 \pm 1,030$; Ni $0,643 \pm 0,444$; Zn $53,240 \pm 1,731$; Co $0,398 \pm 0,123$) and microelements with proven highly toxic effect on living organisms (Cd $< 0,01$; Pb $2,147 \pm 0,985$) was established in the liver of the Fat dormouse inhabiting in a forest shelter belt in agricultural region in the central part of North-eastern Bulgaria.

The bioindicator characteristics found form an initial starting basis for the estimation of heavy metals accumulation in internal organs of Fat dormouse, thus implying that it may serve as a zoomonitor species to detect toxic anthropogenic hazards in other regions of its wide area of distribution in Europe.

Key words: heavy metals; Fat dormouse, *Glis glis*, environmental pollution.

Electrophoretic comparison of blood- Serum proteins of *Dryomys Thomas, 1906* (Mammalia: Rodentia) in Iran

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Globulin and Albumin blood-serum proteins of 28 *Dryomys* specimens which were collected from north-east (Mashhad and Bojnord), west (Kurdistan, Hamadan, Qazvin, and Zanjan), and north-west (Pir-ahmad-kandi, Kelisa-kandi, and Nadou villages) of Iran have been examined using SDS-PAGE method. In residual region of Globulin protein (G), specimens from north-east and west group and north-west group had created 5 and 11 electrophoretic bands, respectively; and in residual region of Albumin protein (A) all specimens created only one band and north-west group created 4 electrophoretic bands. Although these electrophoretic band differences could led to diagnosis of these two *Dryomys* specimens, but this difference along with morphological and **Karyological** properties of these specimens, can help identifying the distribution of *Dryomys nitedula* in north-east and west and *Dryomys pictus* in north-west of the Iran.

Keywords: Albumin, Globulin, Iran, *Dryomys nitedula*, *Dryomys pictus*

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Edible dormice in England: some more details of their lives and activities

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Glis glis is an introduced species in Britain whose numbers and range appear to be increasing. A long-term study of a population northwest of London was begun in 1996, and information based on 13 years of monitoring nest box use has been published recently. Important findings include evidence of exponential population increase and significant longevity in this species. Breeding failure in non-masting years reflects similar studies in Continental Europe and individually marked animals disappear during non-breeding years, but reappear later. Further analysis of data from our nest box inspections reveals interesting details of social relationships and individual movements.

Optimal conservation strategies for the hazel dormouse in fragmented landscapes

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Habitat loss and disruption of structural connectivity are the greatest extinction threats to hazel dormouse populations in European landscapes. Nevertheless little is known on 1) the actual demographic processes that trigger local extinction and 2) the optimal conservation strategies in agricultural landscapes whilst taking into account budget restraints. We propose to report the results of an ongoing large scale project (4 years), carried out in agricultural landscapes in central Italy. Dormice populations were studied using a combination of field-methods including nest-box grids, nest-tube surveys and radio-telemetry. The demographic scope of the study is broad, encompassing several parameters such as local density, extinction and colonization probabilities, individual fitness and dispersal behavior. Demographic data was used to run spatially explicit population models using RAMAS GIS software for two scenarios: 1) no action scenario: what is the probability of extinction if no conservation action is carried out? 2) optimal allocation of resources: what is the best way to invest resources in conservation actions (habitat restoration, increase in hedgerows, woodland management) in order to increase the viability of populations? Results show how the actual cost/benefits of the different conservation actions are strikingly different thus leading to diverging trajectories of the target populations.

Molecular phylogeography of the common dormouse, *Muscardinus avellanarius*, in Europe

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The aim of the present study is to reconstruct the phylogeography of the common dormouse, *Muscardinus avellanarius* in Europe. Recently, a complex phylogeographic pattern with the presence of two highly divergent lineages has been described based on the mitochondrial DNA gene. These two lineages are subdivided into five sublineages genetically isolated. These should be regarded as independent conservation units especially since we observed a low genetic diversity within the lineages and an important level of genetic differentiation between them.

In order to improve our previous data we analyzed 136 *M. avellanarius* across the species' Eurasian range, using sequence data from 3 genes: the mitochondrial cytochrome *b*, two nuclear genes (Apob, Betafibrinogene) and 10 microsatellite loci. The obtained dataset is analyzed using different phylogenetic reconstruction as well as other methods adapted to phylogeography. The preliminary results based on the cytochrome *b* are consistent with our previous analysis and revealed new information about refugia. The concatenation of the two nuclear genes tends to show the same results of the cytochrome *b*. The microsatellite analysis should give more precise information about the evolutionary history of the common dormouse in Europe.

Therefore this work might have important implication for the dormouse conservation.

Genetic diversity and population structure of the common dormouse, *Muscardinus avellanarius*, in Flanders region (Belgium)

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The common dormouse (*Muscardinus avellanarius*) is a very rare and threatened species in Flanders. Surveys revealed that the whole Flemish population seems to be reduced to the eastern part of the municipality of Voeren, where it is connected to the Dutch population.

We can expect that the level of genetic variation within such fragmented and small population is low, and genetic differentiation between patchily dispersed subpopulations is high. In order to assess the genetic diversity and population structure of the common dormouse in this region, we selected 10 microsatellite loci for this study on the basis of polymorphism ascertained in an English dormouse study.

A preliminary genetic analysis was conducted on 65 hair samples of dormouse collected in 2009-2010. The first results revealed at least three different genetic clusters with a low level of gene flow between them. Additional analyses with more samples will complete the genetic results, which will be used by the Mammal Working Group of Natuurpunt to improve advise on dormouse

management in Flanders. Long-term and non-invasive population monitoring that combines capture-recapture methods with molecular tools are the only means to provide reliable answers on population trends in a species.

Surveying dormouse (*Muscardinus avellanarius*) with nest-tubes on large spatial scale with the aid of habitat suitability models and forest inventory data

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The Common Dormouse is a rare and nocturnal species that is endangered in many European countries and difficult to detect without any prior information. As effective conservation is only possible when habitat-use and current distributional range is known, this study focused on applying a standardized survey on a large spatial scale (Federal state of Hesse, Central Germany). In the first instance survey areas were selected based on a state-wide habitat suitability model, suggesting favorable forests where landscape and bioclimatic conditions are suitable. Secondly, study area choice was supplemented by forest inventory data and by site specific characteristics. Eleven areas were finally chosen where no dormouse survey was carried out in the past. To analyze habitat requirements and to ensure reliable proof of dormouse absence and presence 50 nest-tubes were placed in a constant grid (120x120m) in each survey plot. All selected areas are potentially suitable but differing in forest structure, forest age, floral species richness and shrub-density. The tubes were installed in February/March and are checked monthly till September. Information gained by this standardized survey will help to improve methodical aspects of dormouse conservation and will provide a better insight into small- and large-scale habitat use and distribution patterns of the Common Dormouse.

Habitat preferences of *Dryomys Nitedula* in Boreonemoral Forest – results of the study by nest-boxes and radio-tracking

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We studied forest dormouse *Dryomys nitedula* in probably northernmost, isolated and spot-like population found in South-East corner of Latvia. The area is covered by boreonemoral forest were mature, mixed stands of Scotch pine *Pinus sylvestris*, Norway spruce *Picea abies* and birch *Betula pendula* prevail. About 200 wooden nestboxes for the forest dormouse has been put up in the area of 200 ha. Out of them, 100 nestboxes were put up in a 50 x 50 m grid pattern in two study plots. Six forest dormice (3 male and 3 females) were radio-tracked in June and August of 2009. Home range of them varied from 0.38 ha up to 3.57 ha. Dormice preferred to dwell mature forest stands rich with understorey especially of hazel *Corylus avellana* as well as forest edges including those with young spruce and oldgrowth oak *Quercus robur* growing on slopes of small elongated depressions among gently ground moraines. As daytime nest sites radio-tracked animals used

mainly hollowed trees (aspen *Populus tremula*, birch, white *Alnus incana* and black alder *A. glutinosa*). Dormice rarely were found in dense mature or thin forest as well as were not found in overgrown clear-cuts.

Energy budgets in the face of climate change

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Climate change will not only directly affect climatic parameters, such as temperature and precipitation, but ultimately also ecological (nutrition) and physiological parameters of animal species. On this account, distribution boundaries of species will shift due to the after-effects of climate change and in extreme cases this may lead to the extinction of certain species. Because hibernating species pursue an alternative strategy to keep energy budgets positive, they are especially sensitive to temperature changes and thus especially vulnerable to climatic changes. Our study investigates the effects of climate change on hibernation physiology, energy balance and distribution of hazel dormice (*Muscardinus avellanarius*). In northern Germany, increased temperatures during winter due to climate change are already detectable and might increase arousal frequency and early fat depletion of hibernators. To understand whether ambient conditions indeed impact hibernation patterns (frequency of arousals), energy budgets and winter survival, we measured skin temperature and metabolic rate of *M. avellanarius* under natural conditions during winters of different strengths. Here we present our first results on arousal patterns and energy expenditure in regard to ambient temperature. Consequences for winter survival and distribution of *M. avellanarius* facing climate change will be discussed.

State-wide species distribution model for the Common Dormouse (*Muscardinus avellanarius*) based on governmental and data of the “Great Nut Hunt” in combination with climatic, landscape and forest inventory data

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The Common Dormouse is a rare, nocturnal and clandestine species. Current distributional range and status still remains unclear. As area-wide distribution data is scarce we used all existing datasets of governmental (n=172) and “Great Nut Hunt” (n=316) data to build a spatial explicit species distribution model for the federal state of Hesse. For environmental data, we used bioclimatic, landscape, soil and forest inventory information on large-scale but fine resolution (25mx25m). By application of robust statistical methods (Logistic Regression, Boosted Regression Trees) highly reliable models could be constructed (AUC=0.94). Results show that the distribution of the dormouse on a large spatial can only be assessed by rigorously using all available distribution data with high quality environmental information. With the aid of these models we were able to predict suitability for unknown areas resulting in a spatial explicit habitat suitability map. This map will build a basis for future conservation measures and will also be useful in related fields of

dormouse research and conservation e.g. influence of fragmentation. Furthermore, analysis highlighted the importance of climatic conditions on a large spatial scale. This will be increasingly important when considering changing climatic conditions.

Dormice as reservoir hosts for the agent of Lyme borreliosis

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Various dormice serve as reservoir hosts for the agents of Lyme borreliosis which are transmitted by the wood tick *Ixodes ricinus*. Edible, garden and hazel dormice feed numerous subadult ticks. As a result, they frequently become infected by particular members of the *Borrelia burgdorferi* sensu lato complex. The reservoir competence as well as the reservoir capacity of dormice outweighs the contribution of other small rodents in the transmission cycle of this bacterial pathogen. Dormice readily become infected by Lyme borreliosis spirochetes when infected nymphal ticks feed on them, they maintain the spirochetes for an extended period and numerous larval ticks acquire spirochetes during their blood meal on an infected dormouse. We discovered that garden and hazel dormice, but not edible dormice, harbor a unique species of spirochetes which is genotypically and phenotypically distinct from other members of Lyme disease spirochetes. This novel spirochete, named *Borrelia spielmanii*, is pathogenic for people. Each of the various species of spirochetes seems closely associated with only a limited range of hosts, therefore, biodiversity may decrease risk of human infection.

Comparison of two nestbox types and their suitability for *Muscardinus avellanarius*

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This two-year-study has been carried out since 2009 in a low mountain range near the town of Schluechtern, 70 km northeast of Frankfurt am Main, Germany. A total of 23 nestboxes of two different types of construction and size were set up at intervals of 20 m along a hedgerow consisting mainly of blackthorn (*Prunus spinosa*), hawthorn (*Crataegus laevigata*), privet (*Ligustrum vulgare*) and dog rose (*Rosa canina*). A total of 12 wood-concrete 1B SCHWEGLER™ nestboxes with an entrance hole measuring 26 mm, an internal diameter measuring 120 mm and a removable front panel were set up alternately with 11 wooden nestboxes made by a local manufacturer, with an internal diameter of 60 mm and an entrance hole measuring 22 mm.

The aim of the study was to find out whether the small nestboxes would be accepted by hazelmice (*Muscardinus avellanarius*) and if they could help minimize competition with other nestbox users such as Blue Tit (*Parus caeruleus*), mice (*Apodemus* spec.) and insects.

Key words: *Muscardinus avellanarius*, nestbox, competition

Capture-Mark-Recapture study on coexisting dormouse species in the Grand Duchy of Luxembourg

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The present study is the first research project in Luxembourg dealing exclusively with dormice. It is part of a PhD project, which started in spring 2009. The study site is situated at the river Moselle and characterized by a highly diverse small scale habitat mosaic. It includes inactive and active vineyards with dry-stone-walls, thermophilic forests, limestone escarpments, old mines, a canyon and humid scree forests. One hundred live traps were placed in these different habitat types in a 15m-grid, covering approx. 1 ha. They were activated for three nights twice a month. Nest boxes were also placed at the study site. The habitat around the trapping grid was scanned by foto traps for dormouse presence. During 2009 and 2010, 147 Garden dormice and 63 Edible dormice could be marked with PIT tags. Furthermore, tissue and faecal samples were taken for genetic analysis and information on their feeding ecology. Most Garden dormice were found in the vineyard with dry-stone-walls, a site which was almost completely avoided by Edible dormice. Additionally, the Hazel dormouse could be found at the study site from 2010. Data on habitat use and population structure with regard to the different species, sex and age classes are presented.

Distribution of dormice in the Grand Duchy of Luxembourg

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Only very few historic data on the distribution of the three dormouse species in Luxembourg (*Eliomys quercinus*, *Glis glis*, *Muscardinus avellanarius*) are available. In 1993 a survey in the local media was initiated by the National Museum of Natural History (MNHN) – the first attempt to systematically collect data on the presence of dormice in the Grand Duchy. However, the results were not verified. One aim of this study, which is part of a PhD-project, is to validate the available data (credibility, up-to-dateness). Moreover, the survey (newspapers, radio, TV) was repeated in 2009, 2010 and 2011. As preliminary results from these surveys, *Glis glis* seems to concentrate mostly in the Minette region and the Mullerthal area, whereas *Eliomys quercinus* dominates the Moselle valley and is also often found around Ettelbruck. The collected data of the synanthropic species *Eliomys quercinus* and *Glis glis* will be the basis for a habitat model in order to reveal the potential distribution of the Garden and Edible dormouse in the Grand Duchy of Luxembourg. As far as the occurrence of the Hazel dormouse is concerned, the colleagues of the Public Research Centre Gabriel Lippmann (CRPGL) in Luxembourg search for nests and gnawed hazel nuts during autumn.

An estimate of population density of the Fat dormouse *Glis glis*, movement and nest cohabitation in two types of forests in the Transylvanian Plain (Romania)

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Spatially explicit capture - mark - recapture data, obtained by regular nestboxes checks during two summer seasons (2006, 2007), were used to estimate density of *Glis glis* (Linnaeus, 1766) in one oak and one hornbeam dominated forests in the Transylvanian Plain, Romania. The number of captured dormice was positively correlated with the number of occupied nestboxes, although between 10% and 50% of all nestboxes were shared by 2-6 individuals. The percentage of shared nestboxes and number of individuals found inside varied. Dormice tend to aggregate in nestboxes during the mating season, and almost all shared nestboxes containing more than two individuals (males and females) were encountered during that period. Dormice were more solitary in July and August, when females gave birth, but communal nesting was uncommon in our study sites. *G. glis* had higher densities in the oak forest than in the hornbeam forest (11.32 ± 1.46 vs. 4.81 ± 0.70 ind./ha), and also the average distance covered was shorter in the oak forest. The maximum distance covered was below 150 m in the oak forest and below 225 m in the hornbeam forest, but here less than 5% of the distances recorded were greater than 150 m, showing high nestbox fidelity.

Key words: nestboxes, communal nesting, habitat requirements

Habitat requirements of the forest dormouse (*Dryomys nitedula*) in the the north-western corner of the distribution range: preliminary results

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Lithuania is situated in the very north-western corner of large distribution range of the forest dormouse. Only two populations of this species are known in Lithuania at present. One of these populations have been studied since 2001 using nestboxes set up in grid system, regular control of nestboxes and ringing of dormice captured. At this locality, forest dormice prefer mixed Norway spruce (*Picea abies*) stands with birch (*Betula pendula*) and Scotch pine (*Pinus sylvestris*), as well as young Norway spruce plantations, while Scotch pine stands prevail in this forest. Forest dormouse habitat parameters (composition of overstorey and understorey, numbers and cover of different tree and shrub species etc.) were evaluated quantitatively in areas of 2500 m² around 58 nestboxes at this study site. An original ArcGIS-based software application is created and tested in the project (No VP1-3.1-SMM-07-K-01-026) funded by the Research Council of Lithuania. After GIS-analysis, criteria of the optimal habitats and their significance for the forest dormouse population will be discovered. In the conference, preliminary results of this analysis will be presented.

Dryomys nitedula in Mongolia

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The forest dormouse was found at first by the Mongolian-German Biological Expedition in May 1973 in SW-Mongolia in the Dzungarian Gobi in the *Salix*-woodlands near the river Bulgan-gol, about 5 km E of the border China/Mongolia. That area was created as nature reserve in reference to the distribution of the central-asiatic beaver population *Castor fiber birulai*.

The river is running from the Mongolian Altai through the Dzungarian desert up to the lake Uljungur in NW-China. It belongs to the river system of the Black Irtysh. *Salix* and *Populus* species are accompanying the river. First finding of two *Dryomys nitedula* happened by the control of a nest of Black kites (*Milvus migrans* with two little youngs and one egg), which was settled among the nest material below by these rodents. It seems that the population belongs to the subspecies *Dryomys nitedula angelus* Thomas, 1906.

In the later 70ies and 80ies as well as in 2002 we collected a greater material of this species. The hibernation finished in the first days of May. The adult males had active testes at that time and in the second half of May copulations took place, also at the day. Youngs are born in the second half of June in tree nests in a level of 4 m (1.40-7 m; n=100). 19 females were investigated with an average of 5.7 embryos (3-8). It is not clear if we have one or two litters per year. In the middle of August we found a lactating female and young animals with a body mass of 28-35 g and 15-18 g, so perhaps two litters are possible.

After hibernation we analyzed in May the age structure of 98 animals. Two thirds have had their first winter period, one third was older (at least 6 animals have had hibernated the third winter). In some years the population density in the spring was very high with 20 and more animals/ha. In other years with high water floods in the valley the density was remarkable lower. It is not impossible that the species is also distributed in NW-Mongolia N of the lake Ačit-nuur (Bannikov 1954). Further explorations are necessary.

Use of blackbird nest as a resource by garden dormouse (*Eliomys quercinus* L. 1766)

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Nest predation is the primary agent of avian nest mortality exerting a strong selection on avian behavior and life-history strategies. Rodents are known to be an important source of brood losses on passerine birds. Furthermore, bird nest structure can become an important resource for many rodent species as garden dormice (*Eliomys quercinus*).

Since 1996, garden dormice have been increasing its population in an orange grove of SE Spain. In this area, dormice predate on blackbird eggs and chicks and eventually can occupy this nest and use it as a food store or as a reproductive nest. This work examined the effect of dormice predation on blackbird reproductive success and the posterior use of available blackbird nest.

We monitored all the blackbird nests constructed across the spring reproductive season on 2008.

We used the Mayfield nest success method to evaluate daily dormice predation rate. A probabilistic model was proposed to evaluate the multiple possibilities of nest predation and posterior use.

Our results suggest that blackbird responds to dormice predation rate increasing the number of nests constructed. Dormice occupancy month rate depends on nest availability. Dormice prefer to occupy blackbird nests that have not been used by blackbird for its reproduction.

A comparison of nestbox derived home range and the location of the hibernaculum of Edible dormouse *Glis glis* in the Chilterns, England

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The records database of microchipped *Glis* from the Chilterns woodland site in England monitored by Pat Morris was examined to create a list of older animals whose nestbox location history was available for several years. Eighteen of these animals found during early autumn 2008 during routine examination of nestboxes. They were removed from the nestboxes, fitted with radio collars and released in the same nestbox. The previous 'nestbox derived' range of these individuals from all their historical records was mapped. Radiotracking during the day enabled the [varying] location of most animals to be established before they hibernated. After hibernation the locations of 14 animals were found. Comparison of the nestbox derived home range covering several years was compared to the movement to the hibernation site. Many had travelled much farther than the nestbox-derived range had indicated. Animals were carefully excavated from their hibernacula where possible, examined and then replaced. 12 animals were subsequently found in nestboxes during the following active season and the collars removed.

Predation by the Edible dormouse *Glis glis* on woodland birds breeding in nestboxes

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Published work from Germany has showed that *Glis* regularly predate nests of birds and that the date of emergence from hibernation has been advancing faster than the onset of breeding by woodland birds. There has been no similar work on *Glis* predation in Britain. Examination of nestboxes in the Chilterns site, England revealed a number of nesting attempts by woodland birds. All nests were visited twice a week during the spring and early summer 2009 and 2010 [and 2011?] and the progress of the breeding recorded. Predation by Edible dormice was recorded where the evidence pointed to them. Eggs, recently hatched, fledged and adult birds were predated. Predation of the first clutch was greater when the *Glis* emerged early from hibernation (60% vs 25%). Predation levels by *Glis* on the second clutch was similar in both years (50%), though the number of nest attempts was lower than the first.

Hazel dormouse ecology in a pine plantation during restoration to broadleaves

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Conifer plantations have traditionally been suggested as a sub-optimal habitat for Hazel dormice in England and Wales but a survey in 2001 indicated their presence in many plantations of conifer on previously native species sites. A 17ha plantation of Corsican pine planted on a previously broadleaved site in western England is in the process of restoration to native forest by using a variety of techniques of removal of conifers by hand or machinery – traditional thinning, removal of many small groups of pines and removal of larger blocks. A hazel dormouse population there was monitored from 2000 to 2010 and has survived two forest operations in 2003 and 2009. Monitoring of nestboxes, subcutaneous microchipping for individual recognition and radiotracking has allowed measurement of many important parameters, including population density estimation, home range, sex ratio, longevity and survival of both sexes. These have been analysed and will be presented as a comparison to the results of studies reported by Juskiaitis (2008) in Latvia, who used leg ringing for individual identification.

The effects of different attractants on live capturing *Glis glis* in one-way entrance multi-capture traps in England

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40 nestboxes with one-way entrance systems were placed on trees in 3 woodland sites in the Chilterns, England. Four types of attractant were used in an attempt to attract dormice; apple, dropping scent, peanuts and anal gland scent from male dormice. Similar nestbox traps were also put into the ground at hibernation time, to see if dormice would use them when looking for suitable hibernacula in the autumn. The study showed that many of the aerial nestboxes succeeded in trapping *Glis*. C. 80% of the known population were captured. The effect of different attractants on the success of attracting *Glis* was analysed and differences between the male and female susceptibility to these attractants are discussed. Dormice used the artificial hibernation traps, however, the trapping mechanism was much less successful compared with the nestbox traps on trees. Corresponding field studies of the local *Glis* population show that only small juveniles were in the area at the time, indicating that the trapping mechanism is less effective against small *Glis*. Methods of improving the trapping mechanism are discussed.

Nutrition and biocoenotic relations of the edible dormouse (*Glis glis* L., 1766) on the east of the range

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Faeces of the edible dormouse collected in 2005-2008 on Zhiguli Elevation were analyzed. The diet was very poor, included only 9 types of forage. Bulk of the samples included acorns, nuts, birch samaras, leaves and mushrooms. Secondary types were arthropods, bark of trees, seeds of grassy plants, algae and lichens.

Large arthropods as objects of preying were found sporadically. They were represented by insects families Tettigoniidae, Carabidae, Scarabaeidae, Cantharididae, Tenebrionidae, Syrphidae and also slugs Limacidae.

During the analysis of small insects rests swallowed together with food items, various topical and fabric relations of the rodent were evident. Habitation in tree crones was confirmed by finding of dendrobiont bugs Miridae and ants Formicidae. Eating of tree leaves was pointed by rests of phyllophags thrips Thripidae and Phloeothripidae, psyllas Psyllidae, aphides Aphidiidae. Sapromycetophages Oribatellidae, Psocidae, Lygaeidae and Orthoperidae specify that dormice can forage in forest litter. Permanent relation with hollows was confirmed by high occurrence of Tipulidae, Limoniidae, Ceratopogonidae Tabanidae, Tachinidae larvae and also findings of saprophages predators Lithobiomorpha and Staphylinidae. The part of founded insects served as indication of food items, for example, mycetophages Mycetophagidae, ants parasite Mymaridae, midges Cecidomyiidae.

Also species-specific parasite the flea *Nosopsyllus sciurorum* and a number of nonspecific parasites were founded.

Thus, the analysis of nutrition gives not only comprehensive pattern of trophic relations, but also promotes complex estimation of the species ecological niche.

Mass embryo resorption and regulation of reproduction of the edible dormouse (*Glis glis* L., 1766) on the eastern periphery of the range

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Mass embryo resorption phenomenon at the edible dormouse, for the first time revealed in 2008 on the periphery of the range, is considered. We found that this phenomenon exactly determined regular fluctuations of the population age structure in years – sharp domination of one-year-old (2006 and 2008) or two-year-old individuals (2005, 2007 and 2009), in 2010 three-year-old individuals dominated.

Reliable dependence of reproduction from productivity of the oak was revealed ($R_5=0.8$), what was confirmed by the analysis of nutrition. Mass birth of juveniles occurred in productive years anticipating maturing of acorns. Among climatic factors only late frosts during the oak flowering biased the reproduction of dormice ($\tau=0.77$). Influence of population density ($R=0.3$, $p=0.53$) and age structure ($R=-0.6$, $p=0.31$) was not found.

The age of females did not play the main role in reproductive success. Embryo resorption occurred at both one-year-old (90%) and three – four-year-old females (55%). The periods of male activity and female estrus coincided and also could not affect the intensity of reproduction.

Embryo resorption was observed at the majority of placental mammals under the influence of

strong stress factors, but as a part of a resource-dependent mechanism of reproduction regulation mass resorption was observed for the first time.

Monitoring and population study of the common dormouse (*Muscardinus avellanarius*) in Flanders (Belgium)

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The common dormouse is in Flanders a protected and threatened species. Surveys conducted by the Mammal Working Group of Natuurpunt in 2003-2006 revealed that the whole Flemish population seems to be reduced to the eastern part of the municipality of Voeren, where it is connected to the Dutch population. The total Flemish-Dutch population is estimated to be 500 to 1000 individuals.

Standardised monitoring started in 2007 by a yearly nest count along 15 fixed transects in autumn. In summer 2010 a population study was set up to obtain more information on size, composition (age, sex), reproduction, survival, movements and dispersal, habitat use and genetic diversity, in order to improve protection measures. In part of the population (a group of forests and railroad verges that are connected in different degrees), dormice are captured, marked with PIT tags and recaptured during fortnightly checks of nest boxes put up at 100 m intervals. In 6 nest boxes automatic PIT tag readers were installed to obtain more information on nest box use by marked animals. In the whole population hair samples are collected from dormice in nest boxes for microsatellite DNA analysis by the University of Liège. Preliminary results of this study are presented.

Evaluation of *Muscardinus avellanarius* density by nest box compared to trap check

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Population densities of marked *Muscardinus avellanarius* are generally estimated through nest box checks. As dormice shelter also in natural cavities and leaf nests, we used parallel trapping sessions to try to answer the question "what proportion is overlooked in nest box checks". We selected a forest of 1.7 ha where a 5 years nest box survey revealed an annual mean of 3.4 ± 1.4 dormice. The trap design (permanent grid of 76 hanging platforms) was developed in June. During July and August, the traps were set every second week (4 sessions of two nights = 8 nights) resulting in a total of 75 captures with a mean of 9.4 dormice per night and a total of 16 different individuals. The grid of 60 nest-boxes was checked weekly (8 times) which allowed 19 encounters with a mean of 2.4 dormice per control day and the presence of 6 different individuals. Population density estimated by the minimal number of dormice alive revealed from the "calendar of capture" gave for nest-box checks a value of 2.5 animals/ha and for trap checks 6.6 animals/ha. In conclusion, in our forest 62% of the population were overlooked by the technique of nest-box checks.

Testing the use of two types of nest boxes by the Common Dormouse *Muscardinus avellanarius*

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British mammalogists have introduced two systems for surveys of *Muscardinus avellanarius*: first a modified nest box for birds with the entrance facing the tree trunk and promoted then a cheaper and smaller model called “nest tube”. Till now, no comparative data are available. In order to investigate which system is more efficient, we tested big (GB-type) and small nest boxes (DEUFA-type, a commercial wooden mouse trap used without door) in three Swiss forests. In 60 pairs of nest boxes, we conducted 2320 nest box checks during 5 years, to document the direct presence of *Muscardinus*, potential competitors and any signs of activity that suggest occupation. Mean annual occupation and cumulative number of present *Muscardinus* were both significant higher for the Deufa-type than for the GB-type (respective 64.6% versus 32.1%, and 147 versus 67). In contrast, the annual occupation by competitors – *Glis glis*, *Apodemus spp.* and *Parus spp.* – was significant higher in the GB-type than in the Deufa-type in all forests (19-68% versus 0-16% depending on the species and forest). We conclude that smaller nest boxes are better accepted by the common dormouse and are rarely occupied by competitors; they could hence be profitable when studying *Muscardinus* populations with the nest box technique.

Seeing the woods for the trees

IAN WHITE

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The National Dormouse Monitoring Project originated in 1988 when 5 sites were set up in Somerset, England. Over the year 35 visits were made and a total of 384 dormice recorded. 21 years later in 2009 this had grown to 225 sites throughout England and Wales with over 1342 visits made and 5088 dormice recorded. The vast majority of sites are monitored by volunteers who are either interested amateurs or to lesser extent professional ecologists. The aim of the NDMP was to provide:

- A method for the long-term monitoring of dormice populations to in order to detect change at various special scales;
- A long-term data with which to analyse key demographic variables;
- A focus for habitat management beneficial to dormice and also to many other species of wildlife;
- A forum for dormice workers to share information and experiences about their work;
- A facility to allow people to interact with wildlife and green spaces

In general most of these aims have, and continue to be met but it is only recently that we are starting to focus on utilising the presence or potential presence of dormice to encourage good woodland management practices.

One of the problems of the NDMP is that by its nature sites will be set up where dormice are known to be present. Over time the population may fluctuate within abstract boundaries but it may also increase, or decrease to extinction. Unfortunately if dormice decline at a site it is not known whether it is caused by habitat degradation or other factors. Very little habitat data has been collected on any of the NDMP sites and so there is virtually no indication of either the state of

the habitat at the sites or the effect of any habitat management. Furthermore there is a potential difficulty in generating a survey form that will yield potentially useful results but be simple enough to complete by non-botanists who want to be out recording dormice. In 2009 we developed two survey forms one of which asked basic information on Woodland Ownership, woodland type and whether any woodland management was being undertaken. The second asked monitors to complete a survey in June looking at tree canopy cover and shrub density around each dormouse box at their site. The results of these surveys will be discussed here. The expectation is that more dormice will be recorded in areas of low canopy cover and high shrub density but it is quite possible that they might be less discriminating in the habitat structure around the nestbox.

Dispersal movements of edible dormice (*Glis glis* L.) between isolated small forest woodlots in the district of Altenburger Land (Germany: Thuringia)

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The dispersal movements of edible dormice (*Glis glis*) between 10 small forest woodlots in a fragmented landscape in the south of Altenburg (Thuringia) have been investigated from 1999 to 2004. The size of the forest woodlots ranged from 0.6 ha to 17 ha. The shortest distance between the copses was approximately 30 m and the farthest distance about 1 km. The woodlots were surrounded by cultivated fields or grassland, two were separated by a railway line from the other. Regular nest-box checking was used for the study. The animals were marked by ear tattooing. This investigation offers results on dispersal behaviour of the edible dormouse in a fragmented landscape. Among 1107 individually marked animals 17 individual were detected to disperse to another forest woodlot. Thereby they had to cross treeless areas of at least 200 m. It is established, that only males were moving between the forest woodlots, predominantly juvenile and subadult animals. The dispersal events seem to correlate with peaks of population density in some of the forest woodlots. Movements to the most isolated forest patches (1 km) could not be detected.

Habitat factors influencing the distribution of the hazel dormouse (*Muscardinus avellanarius*) in Saxony, Germany

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In Saxony the hazel dormouse inhabits a large variety of different habitats. Incidence of dormice is even known of spruce dominated forests and small isolated woodlands. We searched for evidence of dormice in 100 study plots in Saxony and analysed what habitat factors affect the presence or absence of dormice. As survey methods we used checking of bird nest boxes and nest tubes and searched for gnawed hazelnuts and summer nests.

We found dormice in large coniferous forests as well as in small isolated deciduous woodlands. They seemed to prefer forests and smaller woodlands both abundant in deciduous tree species over hedgerows. Distance to the next habitat occupied by dormice, the diversity of plant species (especially shrubs as feeding plants) and the altitude turned out to be very important factors explaining the occurrence of dormice. This was established statistically. Soil types and the quality of forest edges may also play a role.

We present new data on habitat choice of the hazel dormouse in Saxony. Additionally, we give recommendations for forest management to safeguard the future of this species.

The reactions of *Muscardinus avellanarius* and *Apodemus flavicollis* to the “odor of nest”

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Arboreal rodents are often syntopical and odors' signals are important type of them communications. The aim of our investigations was to determine the reactions of *Muscardinus avellanarius* and *Apodemus flavicollis* to the odor signals of rodents in natural conditions.

Investigations were carried out in forest ecosystems on the territory of Podillia region (W Ukraine) and Jura region (S Poland). The nest-tubes and nest-boxes (totally 442) were used for catching individuals and getting “odor of nest”. The scents' tester (construction by Nowakowski W.) was used for determination of rodent's reaction. 917 tests of reaction were done during 2007-2008. The type of reaction was defined by share of positive tests (%) in sampling.

The reaction of *M. avellanarius* to the homo-specific odor was neutral (54%; $\chi^2=0,83$, $p=0,3609$), as comparative high tolerance is characteristic feature of it. The cause of avoidance to “odor of nest” of *Glis glis* (63%, $\chi^2=5,72$, $p=0,0168$) and *A. flavicollis* (35%, $\chi^2=11,59$, $p=0,0007$) is them the aggressive behavior and dominance.

The reaction of *A. flavicollis* to the homo-specific odor was negative (38%, $\chi^2=1,1$, $p=0,2951$), as it is aggressive and territorial species. *A. flavicollis* reacted to “odor of nest” of *G. glis* neutral (48%, $\chi^2=0,02$, $p=0,8964$) because both species are in same “weight category”. Attraction to “odor of nest” of *M. avellanarius* (59%, $\chi^2=1,1$, $p=0,2943$) is characteristic behavior of *A. flavicollis*, as these species are competitors for nests.