

Status and conservation of the common dormouse (*Muscardinus avellanarius*) in the Province of Limburg (Flanders, Belgium)

Goedele Verbeylen

Natuurpunt Mammal Working Group Flanders, Coxiestraat 11, B-2800 Mechelen, Belgium,
email: goedele@zoogdierenwerkgroep.be

Abstract: The common dormouse (*Muscardinus avellanarius*) is a protected species in Flanders and is suspected to be severely threatened. Since there was insufficient knowledge on the status of the common dormouse in Flanders to propose and implement suitable protection measures, the Mammal Working Group of Natuurpunt started a census in the Flemish Province of Limburg in 2003. Historical data were collected and verified and a large number of forests were searched for signs of common dormouse presence: nests and eaten hazelnuts. In one forest nest boxes and tubes were set up. The new data indicate that the distribution of the common dormouse in the Province of Limburg is currently limited to the region of Voeren. Here signs of its presence were found in five forests, all at least partly forest reserves. In the other two Limburg regions with historical data, Hasselt and Tongeren, no indication of dormouse presence was found. As the Flemish common dormouse population appears to be on the verge of extinction, immediate action is required to save the last of them. Therefore, a complete mapping of distribution and a Population Viability Analysis were not waited for. Based on recent common dormouse observations and expert knowledge, concrete protection measures to improve habitat quality and connectivity are advised. A preliminary management plan for the development of the common dormouse metapopulation in the region of Voeren is proposed.

Keywords: Common dormouse, *Muscardinus avellanarius*, historical data, distribution, protection measures.

Introduction

The common dormouse (*Muscardinus avellanarius*) has declined in numbers and distribution in several countries (e.g. The Netherlands, Denmark, UK) due to its complex biological requirements (Foppen et al. 2002, Vilhelmsen 2003, Bright et al. 2006). It needs a well-structured vegetation to reach a wide variety of food items to survive throughout the year (Bright et al. 2006). Its limited dispersal ability and slow reproduction rate make the species vulnerable when habitat quality and thus population density is low (Juškaitis 2003, Bright et al. 2006). The common dormouse is a strictly protected species in Europe (Habitats Directive annex IV, Bern Convention annex III).

The species is also protected within the frame-

work of Flanders' legislation (Royal Decree of 1980) and is classified as 'threatened' on the Flemish Red List of mammals (Criel et al. 1994). However, prior to 2004 no standardised censuses of the common dormouse distribution had been made in Flanders. Data on the viability parameters of the remaining populations, such as population size, reproduction and survival rates, and dispersal patterns, were lacking. Consequently, knowledge about the status of the common dormouse in Flanders was insufficient for proposing and implementing suitable protection measures. In other countries like the UK and The Netherlands censuses, basic ecological research, and protection measures have already taken place for many years (Foppen et al. 2002, Bright et al. 2006).

Historical data in Flanders comprise of very few scattered observations of individuals and nests (Mammal Database of the Flemish Mammal Working Group, Verkem et al. 2003). These data indicate that, at least up till a few years ago,

there were still some common dormouse populations in the Flemish Provinces of Limburg and Brabant. However there was lack of recent data on the distribution and size of common dormouse populations in these provinces. For the Provinces of East-Flanders and West-Flanders the few observations may have concerned individuals that were unintentionally moved by human activities. There are no data to show whether or not these provinces have or had any permanent common dormouse populations. In the Province of Antwerp there are no historical or recent data.

In this article we describe the progress made by the Natuurpunt Mammal Working Group Flanders between 2003 and 2005 in verifying historical data, mapping present distribution and recommending protection measures for the common dormouse in the Flemish Province of Limburg.

Material and methods

Study area

In the search for possible remaining common dormouse populations, it is very helpful to have

correct and detailed historical data. Thus, at the outset we attempted to verify as much historical data from the Mammal Database as possible by contacting the observers. By assessing these historical observations, based on the experience of the observer and the type of observation (for example animal sighting, nest, gnawed nuts), they were classified as either reliable or unreliable. The historical presence of common dormouse populations was accepted in those locations with one or more reliable observations. Several historical data concerned findings of nests completely constructed from the fluff of old man's beard (*Clematis vitalba*). Since there are now strong suspicions that nests of this material do not belong to common dormouse but to wood mouse (*Apodemus sylvaticus*) or bank vole (*Clethrionomys glareolus*), these data were classified as wrong. Extra data were collected by contacting specialists and field workers and by doing a thorough literature review.

We started our research in 2003 with an excursion to Teuvenenberg (Voeren, Province of Limburg), one of the few locations where we suspected the presence of a remaining population, as it is connected to the Dutch common dormouse population (Foppen et al. 2002). The search continued



Searching for common dormouse nests in old man's beard: not an easy job... Photograph: Dominique Verbelen.

in 2004 and 2005, when we carried out censuses in a range of forests in the Province of Limburg (figure 1, table 2, more details in Verbeylen 2004 and Verbeylen & Verbelen 2006). These locations were selected on a number of criteria: 1. presence of historical data (check for remaining populations), 2. proximity to forests with recent observations (in our case only Teuvenbos), 3. potentially suitable forests according to a coarse analysis based on forest composition, area and age (deciduous forests of at least 20 ha which were established before 1775, Verbeylen 2004) and according to advice from the Forest Ecology and Treatment Team of the Research Institute for Nature and Forestry.

The required permits were obtained from the Forestry and Nature Department of the Flemish Government and the forest owners.

Census design and methods

In 2005, each forest was checked for the presence of optimal or marginal habitat patches, which were indicated on a map. We followed the Dutch habitat classification (table 1)

Different census methods were used to determine the presence of common dormouse. In the UK the use of nest boxes and tubes is strongly promoted as the best method to monitor (and protect) common dormice (Bright et al. 2006). However, since putting up nest boxes and tubes in many forest locations is expensive and not always allowed (especially not in forest reserves) we only used this method in one area (De Kevie, 2004-05) as a test case.

In the other forests we searched for eaten hazelnuts in the immediate surroundings of hazel trees (*Corylus avellana*). This is considered to be the most efficient census method for forests for which there are no data on common dormouse presence (Bright et al. 2006). Common dormice gnaw hazelnuts in a specific way, that can easily be distinguished from other species (Bright et al. 2006). This method has been used in several regions to conduct major surveys (e.g. the 'Große Nussjagd' in Saxony, Germany, and the 'Great

Nut Hunt' in the UK, Büchner & Andy 2005, Bright et al. 2006).

In some years (e.g. 2005) hazelnuts are very scarce and common dormice also occur in sites without hazel. Therefore we also searched the edge vegetation of these forests for common dormouse nests to improve the chance of finding signs of their presence. In The Netherlands this is considered to be the most successful method (Foppen et al. 2002). Nests which were found that were doubtful cases were shown to Dutch specialists (Ruud Foppen, Ludy Verheggen, and Annemarie van Diepenbeek) for confirmation. Various nest features were noted (e.g. size, composition) according to Foppen et al. (2002) on the, for our purpose slightly adapted, Dutch census forms (Verheggen 2002). To provide a rough indication of where the animals are more likely to be found and thus probably most abundant, we included information on the length of the searched transect and the search effort, i.e. number of person-hours spent searching. In interpreting these data it should be remembered that nest searchers can only search certain types of habitat and will not locate nests in hollow trees or up in high bird nests. The method will thus underestimate the abundance and distribution of common dormice. It should also be noted that large search efforts are overrated since people search less thoroughly when they are in large groups, as opposed to small ones and that less suitable forests take less search time per km.

Since our goal was to map the distribution and not to monitor for several years, the surveys were not standardised. All seemingly suitable (in 2005 classified as marginal and optimal) habitat patches were searched as thoroughly as possible for nests. Searches for gnawed hazelnuts were made under the hazel trees passed on our route.

The search period was September-November, except for a few searches for hazelnuts in March-April 2006 and the censuses were carried out by volunteers of the Flemish Mammal Working Group.

All data (details and locations of historical and recent observations, study sites, covered transects, habitat quality, possible protection

Table 1. Common dormouse habitat classification according to Foppen & Nieuwenhuizen (1997).

Habitat type	Habitat class	Structure of brambles (or alternative shrubs ⁴)	Height of brambles (or alternative shrubs ⁴)	Transition zone between open land and forest
edges (of forests, open plots, forest paths and clearings) and small landscape elements (e.g. hedges, hedgerows, sunken roads) ¹	optimal	cover $\geq 50\%$ and width ≥ 100 cm	and ≥ 100 cm	and clearly present, convex
	marginal	cover $< 50\%$ and width ≥ 100 cm	or < 100 cm	or indistinct, concave
	unsuitable ³	cover $< 25\%$	or < 30 cm	or indistinct, concave
forest plots and clearings ²	optimal	cover $\geq 50\%$	and ≥ 100 cm	
	marginal	cover $< 50\%$	or < 100 cm	
	unsuitable ³	cover $< 25\%$	or < 30 cm	

¹ present over a length of at least 10 m² present over an area of at least 10 are³ habitats that fall both into the marginal and unsuitable habitat class (e.g. cover 20 % and height 80 %) are classified as unsuitable⁴ dense berry- or fruit-bearing shrubs, e.g. old man's beard (*Clematis vitalba*), bracken (*Pteridium aquilinum*), hawthorn (*Crataegus monogyna*), blackthorn (*Prunus spinosa*), dog-rose (*Rosa canina*), broom (*Cytisus scoparius*)



Occupied common dormouse nest. Photograph: Dominique Verbelen.

measures, etc.) gathered during our research are stored in the Mammal Database (Access 2003), that is linked to a number of GIS-maps (ArcView 3.2)

Results

Historical data

Table 2 and figure 1 give an overview of the historical common dormouse data that remained after verification. This shows that the very limited historical data for the Flemish Province of Limburg is restricted to three main regions: Hasselt, Tongeren and Voeren. It is not known whether or not common dormice have been present in other Limburg regions in the past.

Habitat classification

Since this was our first experience with assessing

the suitability of habitat patches for common dormouse and as we did not use very detailed maps to indicate our findings in the field, the classification and indication of the size and length of habitat patches was quite coarse. Therefore the habitat maps were only useful to indicate the locations where nest searches should be carried out, not to calculate the exact amount of suitable habitat. Nevertheless, we can say that the amount of suitable habitat seems very small.

Present common dormouse distribution

Common dormouse presence was only confirmed for the region of Voeren (table 2, figure 1). Here we found signs in five neighbouring forests (Broekbos, Konenbos, and the three forest clusters: those of Teuvenerberg, Gulpdal, and Obsinnich, of Veursbos, Roodbos, and Vossenaerde and of Vrouwenbos, Stroevenbos, and Sint-Gillisbos). All of these forests are at least partly forest reserves. No signs were found in any

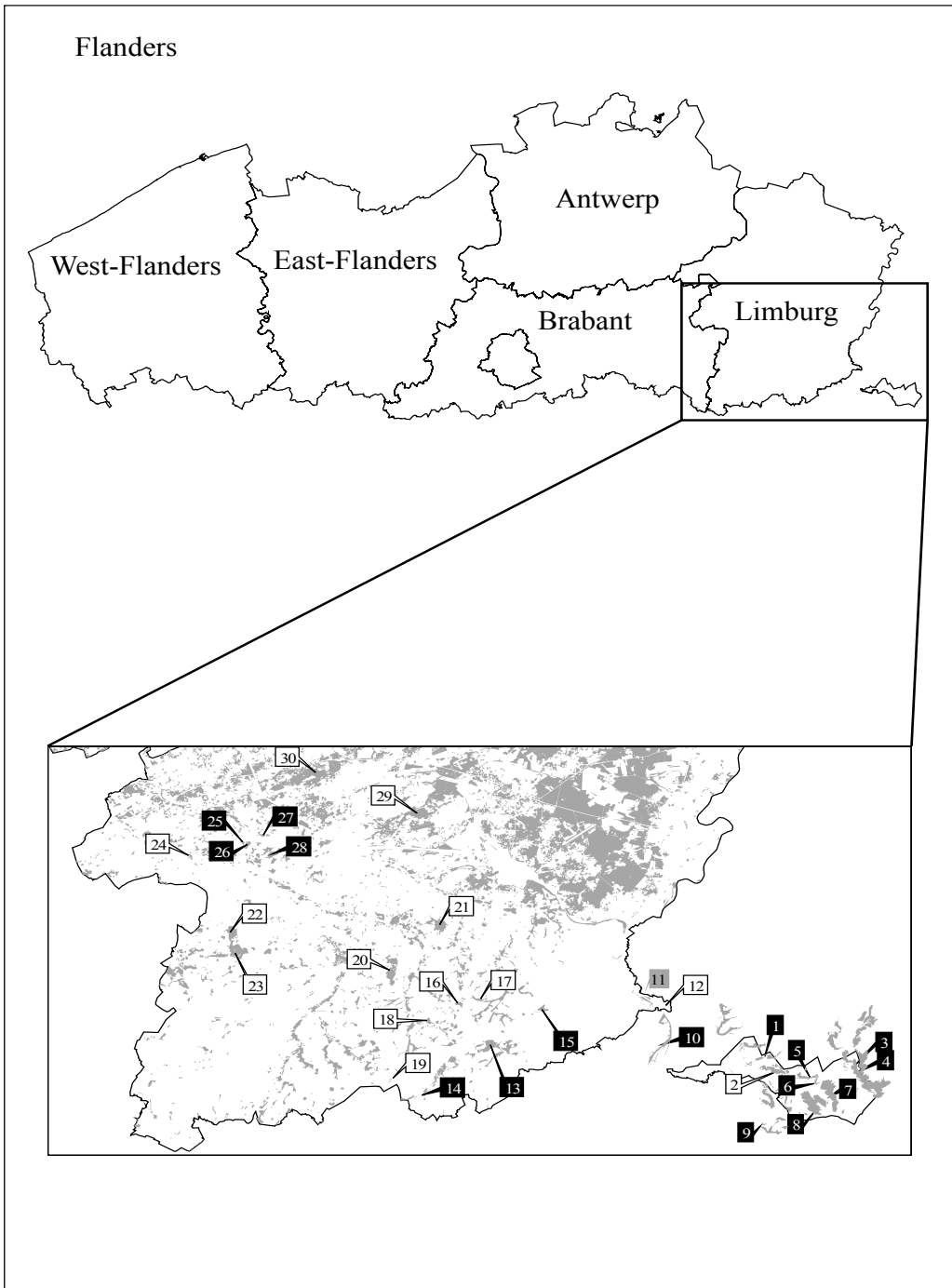


Figure 1. Locations of the historical common dormouse data and the study sites in 2003-05 in the Flemish Province of Limburg and neighbouring Walloon forests. White squares = patches without signs of common dormice during the censuses, grey squares = patches with possible signs, black squares = locations where historical and/or recent signs were found. Forests are shown as grey patches. Numbers correspond with table 2.

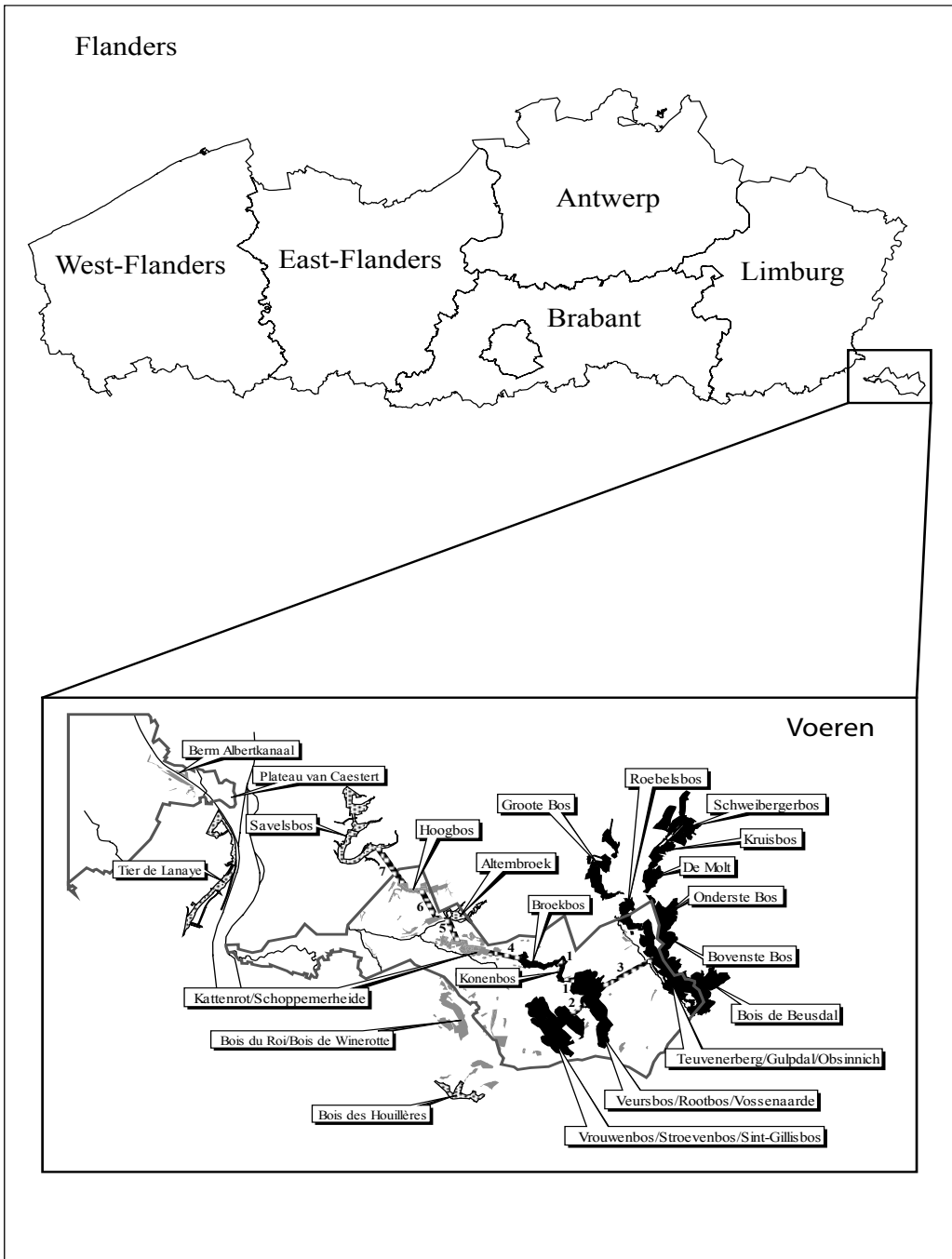


Figure 2. Preliminary vision for the development of a common dormouse metapopulation in the region of Voeren, with priorities (1 to 7) for the corridors (black dotted lines) to be constructed. Black patch = currently occupied forest, dotted black patch = potentially occupied forest with historical observations (Savelsbos = unoccupied), grey patch = potentially occupied forest without historical observations, black line = river. Dutch occupation data are based on Verheggen (2003).

Table 2. Sites with reliable historical common dormouse data ("history", for more details see the Mammal Database of the Natuurpunt Mammal Working Group Flanders, Verkem et al. 2003) and study sites searched for common dormouse signs in 2003-05 in the Flemish Province of Limburg and neighbouring Walloon forests. Per year and study site the number of nests (N?), possible nests (N?), and sightings of common dormice (S), and the presence of eaten hazelnuts (H) is given. Between square brackets the length of the searched transect (km) and the search effort (number of people x minutes spent searching / 100) is given (? = unknown). Non-overlapping transects are given on the same line, partially overlapping transects searched on different dates are given on separate lines. The numbers correspond with the locations in figure 1

n°	Location	Municipality	History	2003	2004	2005
1	Altembroek	Voeren	middle nineties ¹			0 [3.24;3.6]
2	Kattenrot/					
	Schoppemetheide	Voeren				0 [1.04;2.4]
3	Teuvenenberg/ Gulpdal/Obsinnich	Voeren		10-15 N + 2 S [?:±60]	7N+4 S + H [2.34;48.0] 5 N + 6 S [?:?]	3 N [2.31;5.5] 6 N + 1 N? + 1 S [7.73;47.4] H [0.81;2.1]
4	Sinnich (castle attic)	Voeren	1973 ²			1 N [1.66;1.5]
5	Broekbos	Voeren				H [0.17;4.2]
6	Konenbos	Voeren				2 N + 1 S [2.23;1.5] 1 N + 1 S [0.64;1.2]
7	Veursbos/Roodbos/ Vossenaerde	Voeren	before 1971 ³ , 1992 ⁴			2 N + H [7.13;5.3]
8	Vrouwenbos/ Stroevenbos/ Sint-Gillisbos	Voeren				
9	Bois des Houillères	Warsage (Wallony)				1 N [11.66;13.0]
10	Tier de Lanaye	Lanaye (Wallony)	before 1971 ³			
11	Berm Albertkanaal	Riemst				1 N + 2 N? + H [0.91;39.6] 0 [6.54;3.6]
12	Plateau van Caestert	Riemst				2 N? [0.66;±12] 0 [1.68;12.6] 0 [5.74;6.9] 0 [0.34;±7] 0 [3.41;?] 0 [4.06;±25]
13	De Kevie	Tongeren	2001 ⁶			0 [?:?]
14	Lauw (church)	Tongeren	1998 ⁷			
15	Grootbos	Tongeren	1970-76 ⁸			0 [4.83;9.0]
16	Hasselbos	Tongeren				0 [2.51;1.2]

n°	Location	Municipality	History	2003	2004	2005
17	Wijngaardbossen	Tongeren				0 [2.54;1.2]
18	Kolmontbos	Tongeren		0 [2.42;?]		0 [3.18;2.8]
19	Mergelgroeve					
	Vechmaal	Heers				
20	Belle-Vuebos	Kortesseem/ Borgloon		0 [3.25;25.2]		
21	Jongenbos	Kortesseem/ Diepenbeek		0 [3.27;?]		0 [8.01;4.6]
22	Mielenbos/ Mierhoopbos	Sint-Truiden				0 [6.18;4.5]
23	Provinciaal Domein					0 [?:1.1]
	Nieuwenhoven	Sint-Truiden		0 [6.93;?]		0 [3.75;0.9]
24	Harlaz-Olmehof	Herk-de-Stad				0 [2.37;1.8]
25	Wijerstraat	Hasselt	1984-91 ^{10,11}			0 [0.61;0.6]
26	Bundersbos	Hasselt	1985 ^{10,11}			0 [2.07;0.8]
27	Holrakerbos	Hasselt	2001 ¹¹			
28	Herkenrodebos	Hasselt	1972-90 ^{9,10,11,12}	0 [2.13;?] 0 [3.06;14.4]		0 [5.78;2.9]
29	Koebos/Arboretum	Genk				
30	Bokrijk	Heusden-Zolder				0 [?:1.8]
	Vogelzangbos					0 [?:1.8]

¹ pers. comm. Norbert Huys

² Van Winckel 1973

³ van Laar 1971

⁴ pers. comm. Herwig Blockx

⁵ Bonne 1995

⁶ pers. comm. Roger Nijssen

⁷ Mammal Working Group

⁸ pers. comm. Eugène Stassen

⁹ Evers 1972

¹⁰ Lefevre 1991

¹¹ pers. comm. Alex Lefevre

¹² pers. comm. Rik Jacobs

other searched forests in the Flemish Province of Limburg, except for two possible nests in Riemst in 2004. Just across the linguistic frontier, in Tier de Lanaye (Wallony), we also found some signs of common dormice presence in 2004, but not in 2005.

Population densities seem very low, since in 2005 in total only 16 (+ 1 possible) different nests were found. In 2004 adult as well as sub-adult individuals were observed. In 2005 only adult individuals were seen, but the size of several nests (1 nest of 12 cm diameter each in Konenbos, Teuvenenberg, and Veursbos) indicates that reproduction did take place.

Discussion

The common dormouse: a very rare and threatened species in Flanders

All forests with historical data and some neighbouring forests in the Flemish Province of Limburg were searched at least once in the period 2003-05, except for the Holrakkerbos, which is on the census list for 2006. These censuses show that the common dormouse is still present in at least five forests in the region of Voeren, but may have disappeared from the regions of Hasselt and Tongeren. To be more certain of this, we will continue our search in these last two regions for several more years.

Censuses in a number of potentially suitable forests outside these three regions did not reveal any common dormouse observations. Therefore future censuses will be limited to forests with historical data and within a certain distance of these. Firstly, forests within 250 m of the forests with historical presence of common dormice will be inventoried, since this is a feasible dispersal distance. After this, suitable forests within 1500 m of historical populations will be checked for presence, since this is the maximal dispersal distance reported in the literature (Bright et al. 1994). In the region of Voeren we started limited monitoring in 2006 of the forests with a known presence of common dormouse presence.

In 2005 we also conducted in a comparable census in 27 forests in the Province of Flemish Brabant, in collaboration with the Flemish Brabant Union for Nature Study (BRAKONA), the Provincial Government and the Dijleland Nature Study Group (Verbelen et al. 2006). Unfortunately no more common dormouse signs in this province were found, but this search will continue for the next few years.

The causes of the decline are probably to be found in habitat fragmentation and a strong decrease in the amount of suitable habitat, e.g. after the cessation of coppice management, which has led to a more closed canopy and the disappearance of most of the understorey. Additionally, current land use patterns reduce smooth, species rich transitions between forests and open lands, giving rise to very sharp transitions.

Towards a conservation management plan

Although the common dormouse presence in the region of Voeren is more widespread than we first suspected, it is still very limited. A Population Viability Analysis (PVA) should be performed shortly, to provide more insight into possible conservation measures, as has already been done in the Netherlands (Foppen & Nieuwenhuizen 1997). Here a model (LARCH) based on variables that quantify habitat quality, size, and isolation was used to show which networks are presently and potentially sustainable. To properly perform a PVA, we feel that a more complete mapping of the common dormouse distribution, a detailed map of the locations and quality of small landscape elements and a more refined habitat quality map are required. These should also include data from adjacent regions in neighbouring countries. The habitat quality maps could be obtained using printed aerial photographs to indicate the exact location of habitat patches in the field

We will, however, not wait until the distribution is completely mapped, since it might then be too late to save the last Flemish common dormouse. Due to the very limited presence of optimal habitat patches we can be fairly certain that,



Corridor with gaps connecting Konenbos and Veursbos/Roodbos/Vossenaarde. *Photograph: Dominique Verbelen.*

at present there is no sustainable network for the common dormouse in the region of Voeren. In addition the very low density of nests in Flanders (only a few) in comparison with The Netherlands (several dozen over the same edge length, Foppen et al. 2002) indicates that conserving and improving habitat quality in the surroundings of currently occupied habitat patches is of utmost urgency for the short-term survival of the common dormouse in Flanders. For this reason drawing on expert judgement, we have proposed a preliminary habitat management plan to create a more viable common dormouse metapopulation by improving habitat quality and connectivity in the region of Voeren, taking Dutch and Walloon neighbouring forests into account. Using this plan, some measures can be taken immediately.

The study site of Teuvenberg-Gulpdal-Ob-sinnich is connected to the Dutch common dormouse population, which is potentially – and possibly even presently – sustainable (Foppen & Nieuwenhuizen 1997). Two other study sites, Vrouwenbos-Stroevenbos-Sint-Gillisbos (212 ha) and Veursbos-Roodbos-Vossenaerde (172 ha), are large forests that may be potentially sustainable. In these three study sites improving habitat connectivity is less urgent and the focus should be on improving habitat quality. Since 20 ha of well-developed forest is regarded as the minimum area for a viable population (Bright et al. 2006), the two smallest study sites Broekbos (36 ha) and Konenbos (10 ha) cannot be regarded as potentially sustainable. In these forests, improving habitat quality should be supplemented by connecting these forests to each other and to the nearest large forest Veursbos/Roodbos/Vossenaerde (corridor 1 in figure 2)

Within these study sites, three activities can contribute to improving the sustainability of the population. Improving habitat quality is most urgent for the presently occupied habitat patches. Secondly, the quality of, and connectivity to, potential habitat patches within 250 m of recent observations should be improved, as 250 m is a feasible dispersal distance for common dormice (Foppen & Nieuwenhuizen 1997, Verheggen 1997). Thirdly, the same should be done

for potential habitat patches further than 250 m from recent observations. At most locations, an improvement of habitat quality implies improvement of the quality of edges and wood rows. Well-developed forest edges with a gradual transition zone and a high fruit-bearing shrub density can be created by measures such as cutting trees, setting back fences and adapting cattle grazing intensity. These management options had a positive impact on common dormouse populations in the Netherlands (Foppen et al. 2002). Verbeylen & Verbelen (2006) have provided detailed maps with concrete measures to improve habitat quality in the five Flemish study sites occupied by common dormouse, based on detailed management options described by Verheggen (1997) and Bright et al. (2006).

To extend this network and make it more robust, more connections can be made: corridor 2 (feasible due to short distance), corridor 3 (less feasible due to long distance, it would require stepping stones), and corridors 4 to 7 (priorities may change in future if common dormice are found in Kattenrot/Schoppemerheide, Altembroek or Hoogbos) (figure 2). The network could even be extended to Walloon forests, such as the Bois du Roi, Bois de Winerotte, and Bois des Houillères. Connection to Tier de Lanaye is probably not feasible due to too many, and too large, barriers (River Maas, Albert-Channel, A2 Motorway).

The forest reserves and neighbouring properties in the region of Voeren will play a key role in the survival of the common dormouse in Flanders. Since the forest reserves are managed by the Flemish government, which has European obligations to protect this Habitats Directive species, implementation of the most urgent protection measures should be feasible in the short term.

Acknowledgements: This research would not have been possible without the dedication of the volunteers of the Natuurpunt Mammal Working Group Flanders. We also want to thank our Dutch colleagues for their advice, the Forestry and Nature Department of the Flemish Government and the forest owners for the permission to carry out the censuses. We would also

like to thank LIKONA, the Provincial Government of Limburg, and the Forest Ecology and Treatment Team of INBO for their financial and logistical support

References

- Bonne, F. 1995. Verslag Paaskamp Voeren 1995. Ontdekt de ZWG nieuwe zoogdiersoorten voor Vlaanderen? JNM-Zoogdierenwerkgroep, Ghent, Belgium.
- Bright, P.W., P. Mitchell & P.A.A. Morris 1994. Dormouse distribution: survey techniques, insular ecology and selection of sites for conservation. *Journal of Applied Ecology* 31: 329-339.
- Bright, P.W., P.A.A. Morris & T. Mitchell-Jones 2006. The dormouse conservation handbook. Second edition. English Nature, Peterborough, UK.
- Büchner, S. & P. Andy 2005. A public survey for the common dormouse in Saxony. In: Abstracts of the 6th International Conference on Dormice (Gliridae), Siedlce (Poland), 20-24/9/05: 4. University of Podlasie, Institute for Biology/ Centre for Ecological Research, Polish Academy of Sciences/Wildlife Society "Stork", Siedlce/ Lomianki/Siedlce, Poland.
- Criel, D., A. Lefevre, K. Van Den Berge, J. Van Gompel & R. Verhagen 1994. Rode Lijst van de zoogdieren in Vlaanderen. AMINAL, Brussel, Belgium.
- Evers, J. 1972. O.S.C.-uitstap Herckenrode Bossen, 30.4.72. *De Wielewaal* 38 (7): 217.
- Foppen, R.P.B. & W. Nieuwenhuizen 1997. Probleemanalyse ten behoeve van het soortbeschermingsplan hazelmuis *Muscardinus avellanarius*. IBN-report 323. IBN-DLO, Wageningen, The Netherlands.
- Foppen, R.P.B., L.S.G.M. Verheggen & M. Boonman 2002. Biology, status and conservation of the hazel dormouse (*Muscardinus avellanarius*) in the Netherlands. *Lutra* 45 (2): 147-154.
- Juškaitis, R. 2003. Abundance dynamics and reproduction success in the common dormouse, *Muscardinus avellanarius*, populations in Lithuania. *Folia Zoologica* 52 (3): 239-248.
- Lefevre, A. 1991. Waarnemingen van de hazelmuis *Muscardinus avellanarius* in de omgeving van Hasselt (Limburg, België). *Lutra* 34 (2): 61-63.
- van Laar, V. 1971. Gegevens over de verspreiding van de hazelmuis, *Muscardinus avellanarius* (Linné, 1758) in Nederland. Rijksinstituut voor Natuurbeheer, Leersum, The Netherlands.
- Van Winkel, J. 1973. Braakballenonderzoek - Verspreide gegevens. *De Wielewaal* 39 (12): 366.
- Verbelen, D., G. Verbeylen, F. Van Lierop & K. Moreau 2006. Inventarisatie 2005 en verificatie van de historische waarnemingen van de hazelmuis (*Muscardinus avellanarius*) in Vlaams-Brabant (Vlaanderen). Report Natuur.studie 2006/3. Natuurpunt Zoogdierenwerkgroep Vlaanderen, Mechelen, Belgium.
- Verbeylen, G. 2004. Inventarisatie 2004 en bescherming van de hazelmuis (*Muscardinus avellanarius*) in Zuid-Limburg (Vlaanderen). Report Natuur.studie 2004/4. Natuurpunt Zoogdierenwerkgroep, Mechelen, Belgium.
- Verbeylen, G. & D. Verbelen 2006. Endangered... en dan gered? Inventarisatie 2005 en concrete beschermingsmaatregelen voor de hazelmuis (*Muscardinus avellanarius*) in Zuid-Limburg (Vlaanderen), met bijzondere aandacht voor de bosreservaten. Report Natuur.studie 2006/1. Natuurpunt Zoogdierenwerkgroep Vlaanderen, Mechelen, Belgium.
- Verheggen, L.S.G.M. 1997. Actieplan hazelmuis. ROM Mergelland. Plateau van Epenerheide. Stichting IKL, Roermond, The Netherlands.
- Verheggen, L.S.G.M. 2002. Hazelmuisinventarisatie 2001. Een onderzoek naar de verspreiding van nesten in actuele en potentiële leefgebieden in Zuid-Limburg. VZZ-report 2001.31. VZZ/ Adviesbureau Natuurbalans-Limes Divergens, Arnhem/Nijmegen, The Netherlands.
- Verheggen, L.S.G.M. 2003. Hazelmuisinventarisatie 2002. Aanvulling verspreidingsonderzoek Gulpdal, Westelijk Geuldal en Plateau van de Bahnerheide. VZZ-report 2003.19. VZZ/ Adviesbureau Natuurbalans-Limes Divergens, Arnhem/Nijmegen, The Netherlands.
- Verkem, S., J. De Maeseneer, B. Vandendriessche, G. Verbeylen & S. Yskout 2003. Zoogdieren in Vlaanderen. Ecologie en verspreiding van 1987 tot 2002. Natuurpunt Studie and JNM-Zoogdierenwerkgroep, Mechelen and Gent, Belgium.
- Vilhelmsen, H. 2003. Status of dormice (*Muscardinus avellanarius*) in Denmark. *Acta Zoologica Academiae Scientiarum Hungaricae* 49 (Suppl. 1): 139-146.

Samenvatting

Status en bescherming van de hazelmuis (*Muscardinus avellanarius*) in de provincie Limburg (Vlaanderen, België)

De hazelmuis (*Muscardinus avellanarius*) is een soort die in Vlaanderen beschermd en vermoedelijk sterk bedreigd is. Omdat haar status in Vlaanderen onvoldoende bekend was om geschikte beschermingsmaatregelen voor te stellen en uit te voeren, startte de Zoogdierenwerkgroep van Natuurpunt in 2003 een inventarisatie in de Vlaamse provincie Limburg. Historische gegevens werden ingezameld en geverifieerd en een groot aantal bossen werd geïnventariseerd, door te zoeken naar hazelmuisnesten en aangeknaagde hazelnoten. In één bos werden nestkasten en nestbuizen opgehangen. De gegevens wijzen erop dat het huidige verspreidingsgebied beperkt is tot de Voerstreek. Hier werden hazelmuisssporen gevonden in vijf bossen, die allemaal op zijn minst gedeeltelijk aangewezen zijn als bosreservaat. In de andere twee Limburgse regio's met historische waarnemingen, Hasselt en Tongeren, werd geen spoor van hazelmuizen gevonden.

Aangezien de Vlaamse hazelmuispopulatie sterk bedreigd lijkt, wordt niet gewacht met aanbevelingen voor beschermingsmaatregelen, tot het verspreidingsgebied volledig in kaart gebracht is en een leefbaarheidanalyse uitgevoerd is. Op basis van recente verspreidingsgegevens worden concrete beschermingsmaatregelen geadviseerd om de habitatkwaliteit en -connectiviteit te verbeteren. Deze maatregelen betreffen voornamelijk het verbeteren van de kwaliteit van randvegetaties en houtkanten. Goed ontwikkelde bosranden met een graduele overgangszone en een hoge dichtheid aan vruchtdragende heesters kunnen gecreëerd worden door maatregelen als het kappen van bomen, terugzetten van omheiningen en aanpassen van de begrazingsintensiteit. Daarnaast wordt ook het aanleggen van verbindingen tussen bezette habitatplekken en tussen bezette bossen via goed ontwikkelde corridors geadviseerd. Een voorlopig beheerplan voor de ontwikkeling van een hazelmuismetapopulatie in de Voerstreek wordt voorgesteld.

Received: 31 May 2006

Accepted: 17 July 2006



— HAZELMUIS —