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Nest site selection by the dormouse *Muscardinus avellanarius* in two different landscapes

Lena Berg & Åke Berg

Lena Berg and Åke Berg, Department of Conservation Biolo, Swedish University of Agricultural Sciences, P.O. Box 7002, S-750 07 Uppsala, Sweden

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Nest site selection of dormice was studied in two different landscapes in southern Sweden: a forest-dominated landscape and an open landscape dominated by farmland, pastures and apple orchards. Randomly selected plots (10 × 10 m) were searched for dormouse nests and habitat characteristics of plots with and without nests were compared with logistic regression. Number of shrub species, cover of different shrub species and distance to closest forest edge were the main factors that were related to occurrence of dormice. Dormice have earlier been shown to nest in tree hollows, and thus such nests could be overlooked with our method. However, natural cavities are scarce in the habitats investigated here, and it is argued that the observed preferences for shrubby areas close to forests are real, and different shrub species are suggested to be important as sheltered and predator-safe nest sites and as food sources.

1. Introduction

The hazel dormouse *Muscardinus avellanarius* is widely distributed in Europe (Honacki *et al.* 1982), but is rare in large parts of its range. In Britain, the range of the species has been reduced by 50% since the turn of the century (Hurrell & McIntosh 1984). Also in Denmark, the hazel dormouse has decreased, and is now restricted to some of the forested areas in the south-eastern regions (Vilhelmsen 1992). In Sweden the species probably used to have a more continuous distribution (Ahlén 1977), and was previously declining. However, more recent surveys show a fragmented but slightly expanding distribution in the southern parts (Berg 1990).

Most studies of dormice ecology were based on captures in nest boxes (e.g., Wachtendorf 1951, Löhrl 1960, Schulze 1970, 1973, Gaisler *et al.* 1977, Morris *et al.* 1990) and few studies on habitat requirements at natural nest sites of dormice were conducted (*see* van Laar 1979, and Hurrell & McIntosh 1984). Furthermore, the habitat requirements of the hazel dormouse in Britain were studied by Bright and Morris (1990), who found that coppiced woodland, with an unshaded understorey and high species diversity, was the best habitat for dormice. Several other studies (e.g., Gaisler *et al.* 1977) found that a well developed understorey increase dormice numbers. Moreover, according to Bright and Morris (1994), relatively large ancient woodlands were preferred, and the fragmentation of suitable habitats was a major problem for the long-term survival of the dormouse. Also in Sweden, the occurrence of dormice seems to be associated with shrubs and early successional stages of woody vegetation (Berg 1996).

However, the hazel dormouse may use a range of different habitats including temporary habitats such as clearcuts (Ahlén 1984), and the specific habitat requirements of the dormouse are not fully understood. Even though the dormouse is restricted to southern parts of the country, the landscape varies considerably within its range. The aim of this study was to identify habitat preferences of the hazel dormouse in one forest-dominated landscape and one more open landscape dominated by farmland.

2. Study areas and methods

The study was conducted in two geographically separated areas in Sweden. The south-central study area, Östergötland (57°55´N, 15°20´E), was dominated by cultivated coniferous forests with small patches of farmland and grazed areas. Farmland and grazed areas constituted less than 20% of the area. The forested areas consisted of different successional stages, from new clearcuts to mature forest. The dominating coniferous species was spruce *Picea abies*, except in dry areas where pine *Pinus silvestris* was more common. Deciduous vegetation was found mainly along forest edges, streams and lake shores, and as secondary growth in disturbed areas. Birches *Betula* spp. and aspen *Populus tremula* were the most abundant deciduous tree species. Juniper, *Juniperus communis*, occurred in grazed and recently abandoned pastures and along roadsides. Clear-cut areas, abandoned farmland and abandoned pastures were normally planted with spruce, and initially often colonised by birch, aspen, oak *Quercus robur* and hazel *Corylus avellana*. Raspberry *Rubus idaeus* occurred regularly on clearcuts.

In the southern area, Skåne (55°40´N, 14°15´E), the landscape was dominated by intensively cultivated farmland, apple orchards and pastures, with fragmented woodlands. Since the occurrences of dormice were restricted to areas where woodlands were more continuous, a study area with relatively high proportion of woodland (about 40%), and where dormice were known to occur was chosen. A large number of shrub and tree species occurred (*see* Appendix). In the grazed areas bramble *Rubus fruticosus*, blackthorn *Prunus spinosa,* and juniper were abundant. The woodlands were dominated by beech *Fagus sylvaticus*, i.e. high-forest with no understorey, and areas with young hornbeam *Carpinus betulus*. Ivy *Hedera helix* occurred sparsely, while honeysuckle, *Lonicera periclymenum*, was locally abundant.

The total size of each study area was approximately 10 km^2, and data were collected in random plots (10 × 10 m). The positions of the plots were obtained from randomly chosen coordinates on grid systems at the two study areas. In 1989, 50 plots in each area were surveyed. In 1990, the data set was supplemented with another 20 plots in Östergötland and 18 plots in Skåne. Each plot was searched thoroughly for dormouse nests and the cover of different shrub and tree species was estimated within 5% intervals. In October and November, the censuses were conducted after defoliation when nests are most easily found. Woody vegetation less than 4 m high were considered as shrubs, and individuals higher than 4 m as trees. Mean tree height (m) and shrub height (m) were measured. If the plot was located in an open area (vegetation with a mean height of less than 1 m), the distance from the plot to the nearest forest (woody vegetation with a mean height of more than 4 m) was measured, and if the plot was located in a forest, the distance to the nearest open area was measured. The numbers of different tree and shrub species were counted in each plot, and the cover of all shrub and tree species was estimated, respectively (*see* Appendix).

Logistic regression was chosen to relate the binary ordinal dependent variable (presence/absence) to both binary and continuous independent variables (Hosmer & Lemeshow 1989, Trexler & Travis 1993). To discriminate between variables that were associated with the occurrence of dormouse nests a stepwise logistic regression was performed (dichotomous, 50 iterations, $p = 0.05$ for variables to be entered or removed from the model (SAS Institute 1993)). Occurrence of dormouse nests was related to 47 habitat variables (independent variables) in the logistic models (*see* Appendix).

Additionally, nests were searched for in a variety of potential dormouse habitats within the two study areas during 1987 and 1988, and were used for a comparison between sites with breeding nests, and sites with smaller nests, in relation to vegetation structure, cover, and species richness of trees and shrubs. Nests with a diameter of 11 cm or more were classified as breeding nests. More than 90% of the litters were found in nests with a diameter of 11 cm or more ($n = 12$, mean ± SD = 12.2 ± 1.1). Nests smaller or equal to 8 cm were classified as used by males or subadults. Intermediate nests, 9–10 cm, were excluded.

3. Results

The number of shrub species, coverage of shrubs and distance to forest edges were the main factors that were related to the occurrence of dormice. In Östergötland, plots with dormouse nests had a significantly higher number of shrub species, and a higher coverage of junipers and hazel than plots without nests (Fig. 1). In Skåne, the total cover of all shrub species was higher in plots with nests, than in plots without nests. Plots with nests were located significantly closer to forest edges than plots without nests (Fig. 2).

The large number of habitat variables (Appendix) used in the logistic regressions could have resulted in unstable models. Therefore, an effort was made to reduce the number of habitat vari-

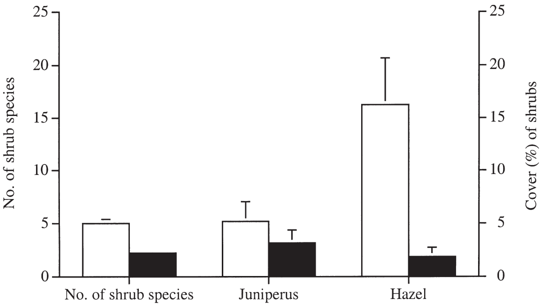

Fig. 1. Mean (± SE) number of shrub species and cover (%) of junipers and hazel shrubs in 23 plots with hazel dormouse (light bars) and 47 plots without hazel dormouse (dark bars) in Östergötland. Differences between plots with and without the hazel dormouse were significant for no. of shrub species ($\chi^2 = 30.7$, df = 1, $p = 0.0001$), cover of hazel ($\chi^2 = 9.1$, df = 1, $p = 0.0026$) and cover of juniper $\chi^2 = 8.5$, df = 1, $p = 0.0036$).

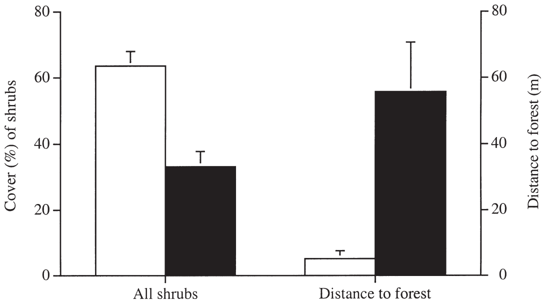

Fig. 2. Mean (± SE) total shrub cover (%) and distance to forest edge in 24 plots with hazel dormouse (light bars) and 44 plots without hazel dormouse (black bars) in Skåne. Differences between plots with and without the hazel dormouse were significant for total cover of shrubs ($\chi^2 = 14.7$, df = 1, $p = 0.0001$) and distance to forest edge ($\chi^2 = 6.7$, df = 1, $p = 0.0097$).

ables with a principle components analysis, but this gave only a slight reduction in the number of habitat variables, and therefore the results from the PCA-analysis was not used in further analyses. However, logistic regressions including only habitat variables significantly associated to occurrence of dormouse nests (*see* Figs. 1 and 2) gave the same results as the original models (i.e. only slight changes in χ^2-values and p-values). Thus, the found relationships between occurrence of dormouse nests and number of shrub species, cover of different shrub species and distance to forest seemed to be real, and not artefacts due to statistically unstable models.

Observed and expected number of nests in different shrub species in Östergötland, differed significantly (Fig. 3). In Östergötland, juniper was the most common nest site species and was strongly preferred as a nest site when compared with its abundance (Fig. 3). Young oak was the second most common nest species in this area, although it was not preferred in relation to its abundance. Other species were less common as nest sites, but aspen seemed to be preferred, while raspberry, hazel, birch and spruce seemed to be avoided, in relation to their abundancies (Fig. 3).

In Skåne, the observed and expected number of nests in different shrub species did not differ significantly (Fig. 4). However, bramble was the most common nest site and was also slightly preferred in relation to its abundance. Furthermore, junipers, honeysuckle, blackthorn and *Rosa* spp. shrubs were preferred as nest sites, although less common than bramble in absolute numbers. Hornbeam, hawthorn *Crataegus* spp. and hazel seemed to be avoided as nest sites when compared with their local abundance (Fig. 4).

A relatively large proportion of the nests were breeding nests. In Skåne, 58.8% of 17 nests, and in Östergötland 70.1% of 77 nests were classified as used for reproduction. The relatively small amount of nests, and the large number of variables (including several class variables) did not allow a multivariate test on habitat differences between reproductive and non-reproductive nests. However, univariate tests suggest that there were no significant differences in habitat composition between nests used for reproduction and other nests (t-tests and χ^2-tests, all $p > 0.2$).

4. Discussion

In this study, the presence of dormouse nests was used as an indicator of dormouse presence. The method was used in previous dormouse studies (e.g., Hurrell & McIntosh 1984, Berg 1996). Drey counts were also used successfully to estimate population density of other species like grey squirrels *Sciurus carolinensis* (Don 1985), and red squirrels *Sciurus vulgaris* (Wauters & Dhondt 1988). The drawback with our method is the difficulty of being sure that dormice are absent when nests are not found. Char-

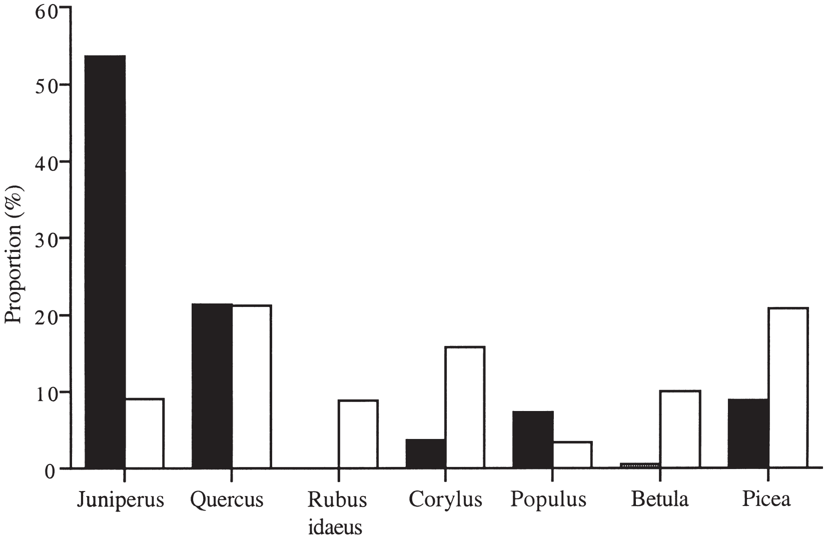

Fig. 3. Proportion (%) of 203 dormice nests in the south-central area (Östergötland) in different shrub species (black bars) in relation to their proportion (%) of the total shrub coverage (light bars). Only species with more than 5% of the nests or species covering more than 5% of the shrub areas are included. Differences between observed and expected number of nests in different shrub species were significant ($\chi^2 = 122.8$, df = 6, $p < 0.001$).

acteristically gnawed hazel-nut shells were used as indicators of dormouse occurrence (Hurrell & McIntosh 1984, Bright *et al.* 1994), a method that works only where hazel is present. Bright and Morris (1991, 1992) used radio tracking and found that dormice often nested in hollow trees, and such nests are easily overlooked with other methods. They, therefore, argued that observed preferences for nesting in shrubs (e.g., bramble, *see* Hurrell & McIntosh 1984) are overestimates due to a bias from the method used. Furthermore, Bright and Morris (1990) found that nest boxes attracted dormice and even enhanced the density, and suggested that tree holes are important as nest sites, at least in diverse low-growing woodland (Bright & Morris 1991), and coppice woodland (Bright & Morris 1992) in Britain.

Shrubby areas may, however, be of crucial importance for dormice in habitats that provide few suitable nest holes, such as old beech forest, young hornbeam or managed coniferous forest (Haapanen 1965, van Balen *et al.* 1982, Sandström 1992), which were dominating forest habitats in the present study. This is also emphasised by the fact that dormice are frequently caught in traps in areas with a high proportion of shrubs (Berg & Berg 1997). A high reproductive success in shrubby areas is indicated by females with young that were found in breeding nests in summer, and the relatively large proportion of juveniles and subadults that were trapped in autumn (Berg & Berg 1997). Furthermore, nest box studies in Sweden (L. Berg unpubl.) suggest that dormice prefer to nest in shrubs also where nest boxes are available. Thus, it seems reasonable to assume that dormice nest in shrubs to a higher degree in Sweden than in Britain. The difference in nest site preference is probably due to differences in forest structure between the study areas in Britain and Sweden (see above), but climate, i.e. amount of rain, and predation may also affect the choice of nest site. In Östergötland, climbers do not occur at all, which may make nests in tree hollows less attractive, since the risk of being discovered by predators is likely to be larger on leafless branches and stems. However, in Skåne, where species composition and forest structure are more similar to British study areas, climbers like honeysuckle and ivy do occur, but breeding nests are still frequently found in shrubs.

In general, the amount and diversity of shrubs seem to be important for many animal species, especially in open habitats such as farmland and clearcuts. Shrub areas seem to be important for small mammals, such as voles and mice, both for protection within home ranges (Hansson 1989) and as dispersal routes (Hansson 1987). Several bird species occurring in farmland landscapes were shown to be positively associated with the amount of protective shrubs (Loman & von Schantz 1991, Berg & Pärt 1994), and the number of farmlands bird species in farmland landscapes was proved to be positively correlated with the amount of edge habitats, i.e. shrubby areas (Robertson & Berg 1992). Furthermore, many insects are characteristic for different shrub species. For instance, 73 Swedish butterfly species have *Prunus* shrubs as hosts during their larval development, and many other species feed on nectar and pollen as adults

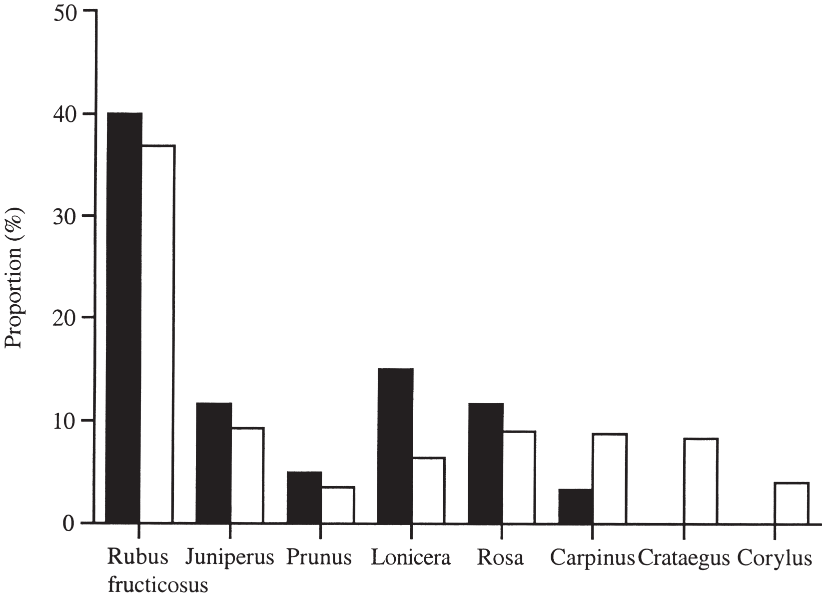

Fig. 4. Proportion (%) of 60 dormice nests in the southern area (Skåne) in different shrub species (black bars) in relation to their proportion (%) of the total shrub coverage. Only species with more than 5% of the nests or species covering more than 5% of the shrub areas are included. Differences between observed and expected number of nests in different shrub species were not significant ($\chi^2 = 12.2$, df = 7, $p = 0.095$).

(Svensson 1993, and B. Ehnström pers. comm.). Thus, intensive clearing or grazing of pastures, edges and other shrub habitats might have negative effects on many species, since a mosaic of shrubs and open grassland seem to be necessary for them.

In forest habitats, most species seem to be affected by tree-species composition, forest age and other variables associated with the forest structure, and shrubs seem to be less important than in open habitats. Among the red-listed forest species in Sweden, the amount of old (especially deciduous) trees and dead wood are suggested to be the most important factors regulating the occurrence of these species (Berg *et al.* 1994). Also among more common birds, tree species and forest age seem to be the major factors affecting the composition of bird communities (Gates & Gysel 1978, Nilsson 1997). A well developed understorey (i.e. large foliage volume) was also shown to affect the diversity and abundance of birds positively (Martin 1988).

The preference for areas with a high proportion of junipers in Östergötland and the preference for areas with a high total shrub cover in Skåne was probably partly due to the importance of shrubs as sheltered nest sites. Bramble and honeysuckle also seemed to be preferred for nesting, since these species are over-represented as nest sites in comparison to their occurrence in Skåne. Dormouse nests are completely covered with the entrance hole on the side, and are often found in forest edges and fringes (Wachtendorf 1951, Schulze 1973, van Laar 1979, Ahlén 1984, Berg 1990), probably due to favourable vegetation structure. Corvid birds like the jay, *Garrulus glandarius,* hooded crow, *Corvus corone*, and magpie, *Pica pica*, are commonly found in edge habitats (Andrén 1992), and are potential predators on dormouse nests. Several studies suggested that predation rates on bird nests are higher in forest edges (e.g., Gates & Gysel 1978, Andrén & Angelstam 1988, Yahner & Scott 1988). However, Møller (1989) found that while open bird-nests suffered higher rates of predation in the edge habitat, partly covered bird nests experienced a consistently low level of predation across a field-woodland ecotone. Thus, density of the vegetation and the degree of cover seem to affect nest predation rates at edges, a conclusion which is also supported by other studies (Redmond, Keppie & Herzog 1982, Yahner & Cypher 1987, Møller 1988), suggesting that shrub areas preferred by dormice are relatively predator-safe.

Dormice mainly feed on tree flowers, buds, seeds and berries (Arwidsson 1926, Bright & Morris 1990, 1992, 1993, Juskaitis 1993), although insects also may be of importance (Holisova 1968, Richards *et al.* 1984, Bright & Morris 1993). The preference for areas with a large proportion of hazel in Östergötland (which was not preferred as nest site) was probably due to its importance as a food resource (Richards *et al.* 1984, Bright & Morris 1993). The correlation between dormouse occurrence and shrub species diversity in Östergötland was probably related to the occurrence of a continuous food supply in diverse areas. Dormice were shown to forage selectively on different plants species during different periods (i.e. late May, late June, early August and mid October), and the continuity of food supply in areas with a diverse plant community is important (Bright & Morris 1993). Furthermore, dormice are arboreal, and horizontal branches and shrubs are used for movements, while open areas are avoided (Bright & Morris 1991, 1992, Berg & Berg 1997). This is consistent with our results from Skåne, where the nests were found in areas close to forests, but not in more open habitats, suggesting that open areas where dormice cannot move above the ground are avoided. Consequently, in a highly fragmented landscape, dormice are more often found in the remaining large continuous woodlands (Bright *et al.* 1994). The distribution pattern in Sweden also suggests that open farmland areas are important dispersal barriers (Berg 1990), and introductions into suitable isolated patches have been successful (L. Berg unpubl.) In Sweden, forests cover 59% of the total land area (Official Statistics of Sweden 1991), and the use of temporary habitats, such as clearcuts, may be a consequence of the possibility for dormice to cross a relatively unsuitable forest matrix to reach a more suitable habitat. Similarly, several bird species breeding in shrub areas in farmland, also breed on clearcuts during a few years in early forest succession (Hansson 1983, 1994). This may explain the slightly expanding range, and the relatively stable populations of dormice observed in Sweden (Berg 1990). The decreasing ranges and populations of dormice in some other European countries (e.g., Bright *et al.* 1994, Vilhelmsen 1992) are probably effects of the fragmentation of forest into patches surrounded by unfavourable open farmland over which dormice are unable to disperse. In such a landscape, the occurrence of hedgerows or other types of connections between suitable patches are of great importance for the dispersal of this species . Thus, the specific habitat requirements of the hazel dormouse, in terms of vegetation structure, food resources, safe nest sites and dispersal corridors, makes it vulnerable to both modern forestry and intense farming.

In conclusion, safe nest sites are of crucial importance for dormice, and in this study it is suggested that shrubs provide attractive nest sites in Swedish forests and farmland. Furthermore, we suggest that food resources may restrict dormouse abundance in silvicultural landscapes, where species diversity of shrubs and trees is low. On the other hand, difficulties of dispersal may be a main factor restricting dormouse distribution in an open agricultural landscape where dispersal corridores are missing, but species diversity is high. However, to fully understand the ecological significance of shrubs, further investigations needs to be conducted.

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Appendix. Mean (± SD) of measured variables for all plots, with and without dormice in Östergötland and Skåne. Cover of shrubs and trees are measured in percent of plot area (10 × 10 m). Individuals of woody vegetation less than 4 m high, were considered as shrubs and individuals higher than 4 m as trees.

Variable	Skåne			Östergötland		
	Total *n* = 68	Dormouse *n* = 24	No dormouse *n* = 44	Total *n* = 70	Dormouse *n* = 23	No dormouse *n* = 47
Distance to open area	16.2 ± 38.0	8.0 ± 27.7	21.0 ± 42.4	20.1 ± 51.9	0.8 ± 3.1	30.5 ± 61.8
Distance to forest	36.5 ± 82.3	4.9 ± 12.2	54.8 ± 98.9	36.4 ± 68.4	48.5 ± 73.2	30.1 ± 65.7
Total tree cover	34.7 ± 35.9	23.8 ± 20.6	41.0 ± 40.2	27.4 ± 33.4	17.5 ± 23.3	32.6 ± 36.8
Mean tree height (m)	6.9 ± 5.7	7.7 ± 4.1	6.5 ± 6.5	6.5 ± 7.7	3.8 ± 4.7	8.0 ± 8.6
Total cover of shrubs	43.9 ± 30.1	62.6 ± 22.4	33.0 ± 30.0	42.7 ± 30.0	65.1 ± 23.2	30.7 ± 25.9
Mean shrub height (m)	1.6 ± 1.2	1.8 ± 1.4	1.3 ± 1.1	2.0 ± 0.9	2.4 ± 0.6	1.8 ± 0.9
COVER OF TREES						
Quercus robur	3.9 ± 11.2	3.6 ± 10.0	4.1 ± 12.0	3.4 ± 10.4	2.5 ± 7.4	3.9 ± 11.8
Carpinus betulus	8.4 ± 22.0	2.4 ± 6.6	11.7 ± 26.7	0	0	0
Fagus sylvaticus	8.3 ± 23.8	1.0 ± 4.1	12.6 ± 29.1	0	0	0
Fraxinus excelsior	0.8 ± 3.0	0.7 ± 2.2	0.8 ± 3.4	1.3 ± 5.6	1.3 ± 6.1	1.3 ± 5.4
Corylus avellana	2.1 ± 12.1	2.0 ± 6.3	2.2 ± 14.5	0	0	0
Pinus silvestris	0	0	0	4.5 ± 15.1	1.3 ± 5.2	6.2 ± 18.2
Populus tremula	0	0	0	4.1 ± 14.7	1.3 ± 5.2	5.6 ± 17.7
Acer platanoides	3.0 ± 9.6	3.0 ± 10.6	3.0 ± 9.0	0	0	0
Prunus avium	1.6 ± 5.6	3.2 ± 8.0	0.7 ± 3.4	0.4 ± 3.6	1.3 ± 6.1	0
Sorbus aucuparia	0.2 ± 1.3	0.2 ± 1.0	0.2 ± 1.5	0.5 ± 2.7	0.4 ± 2.0	0.5 ± 3.0
Betula pubescens	1.1 ± 4.3	0.8 ± 4.0	1.3 ± 4.5	2.8 ± 10.5	1.7 ± 4.8	3.5 ± 12.5
Picea abies	0.2 ± 2.4	0.8 ± 4.0	0	9.5 ± 21.2	7.3 ± 18.2	10.7 ± 22.7
COVER OF SHRUBS						
Rubus fruticosus	15.5 ± 23.7	28.1 ± 27.0	7.8 ± 17.5	0	0	0
Juniperus communis	3.9 ± 12.0	6.2 ± 17.0	2.5 ± 7.7	3.8 ± 8.6	5.1 ± 9.2	3.2 ± 8.4
Prunus spinosa	1.5 ± 8.1	2.4 ± 12.0	1.0 ± 4.7	0.1 ± 0.4	0 ± 0.2	0.1 ± 0.4
Lonicera periclymenum	2.7 ± 11.5	1.6 ± 5.0	3.3 ± 14.0	0	0	0
Quercus robur	0.4 ± 1.5	0.2 ± 0.6	0.5 ± 1.8	8.9 ± 16.3	14.2 ± 20.0	7.1 ± 14.4
Rosa spp.	3.8 ± 8.1	5.1 ± 9.7	3.1 ± 7.0	0.5 ± 2.1	0.9 ± 2.8	0.3 ± 1.5
Carpinus betulus	3.7 ± 10.7	3.6 ± 8.5	3.7 ± 12.0	0	0	0
Fagus sylvaticus	0.2 ± 0.9	0.2 ± 1.0	0.2 ± 0.8	0	0	0
Crataegus monogyna	2.5 ± 11.3	0.3 ± 1.1	3.8 ± 14.1	0 ± 0.4	0.1 ± 0.6	0
Rubus idaeus	0.0 ± 0.4	0.1 ± 0.6	0	3.7 ± 13.4	2.3 ± 8.3	4.4 ± 15.4
Pyrus malus	1.0 ± 6.2	0.2 ± 1.0	1.5 ± 7.8	0.1 ± 0.3	0.1 ± 0.4	0.0 ± 0.3
Urtica dioica	1.1 ± 4.2	2.7 ± 6.6	0.2 ± 1.5	0 ± 0.4	0.1 ± 0.6	0
Fraxinus excelsior	0.5 ± 2.1	0.9 ± 1.8	0.3 ± 2.3	0.7 ± 4.3	1.2 ± 6.1	0.5 ± 3.0
Corylus avellana	1.7 ± 5.7	2.6 ± 7.8	1.2 ± 4.0	6.6 ± 14.8	15.6 ± 21.4	1.9 ± 6.0
Pinus silvestris	0	0	0	0.7 ± 2.4	0 ± 0.2	1.0 ± 3.0
Alnus glutinosa	0	0	0	0.5 ± 1.6	1.2 ± 2.5	0.1 ± 0.7
Populus tremula	0	0	0	1.4 ± 6.1	2.3 ± 8.3	0.9 ± 4.6
Salix caprea	0.4 ± 1.8	0.2 ± 1.0	0.5 ± 2.1	0.8 ± 2.8	1.8 ± 4.2	0.3 ± 1.5
Acer platanoides	0.6 ± 2.0	0.4 ± 1.4	0.7 ± 2.2	0.1 ± 0.8	0.2 ± 1.0	0.1 ± 0.7
Sorbus aucuparia	0.5 ± 2.7	0	0.7 ± 3.4	0.4 ± 1.6	0.2 ± 0.5	0.5 ± 1.9
Betula pubescens	0.7 ± 3.0	0.4 ± 2.0	0.8 ± 3.4	4.2 ± 11.1	4.6 ± 9.5	3.9 ± 11.9
Lonicera xylosteum	0.3 ± 2.4	0	0.5 ± 3.0	0.7 ± 3.7	1.6 ± 6.1	0.2 ± 1.1
Picea abies	0	0	0	8.7 ± 14.2	12.0 ± 16.2	7.0 ± 12.9
No. of tree species	1.2 ± 1.1	1.4 ± 0.8	1.2 ± 1.2	1.0 ± 1.0	0.9 ± 1.0	1.1 ± 1.1
No. of shrub species	2.5 ± 1.9	3.2 ± 1.6	2.1 ± 2.0	3.1 ± 2.0	5.0 ± 1.9	2.2 ± 1.3
No. of tree & shrub species	4.6 ± 2.0	4.6 ± 1.4	4.3 ± 2.4	4.8 ± 2.0	5.9 ± 1.8	3.5 ± 1.5