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BREEDING DENSITIES OF COMMON BREEDING SPECIES IN MANAGED MIXED AND MOIST FORESTS IN PÄRNUMAA, ESTONIA

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Breeding territories of forest birds were mapped in Pärnumaa County in the summer of 2005. Study area was 1 km². The aim was to obtain data of breeding densities of the species commonly breeding there. The study area was mainly made up by mixed and moist forests of 0-80 years (mean 30 years). Multiple mapping method (Koskimies & Väisänen 1988) was used and recommendations are provided for applying it in Estonia. The numbers and densities of breeding species in the study area are represented in Table 3. On the study area there were at least 336 breeding territories of 40 different species.

Introduction

In order to estimate the number of birds in an area multiple mapping is necessary. There is still too little data about the quantity of the avifauna in the forests of Estonia, especially in the forests on mineral grounds. Counts have been carried out decades ago and mostly in places with numerous birds or places that are for some other reason exceptional, for example cemeteries, broad-leaved forests and spruce groves on fertile soil (Randla 1962, Rootsmäe & Rootsmäe 1969, Rootsmäe & Rootsmäe 1993, Rootsmäe 1994). Data collected in such areas are of low relative importance and do not reflect the actual condition in the forests of Estonia. Somewhat more forest types have been observed in the middle of the past decade (Vilbaste 1958, 1965, 1990). However, forests on fertile grounds, mature or even much older forests predominate in these studies. The most credible work has been published by Vilbaste in 1965 and includes also heath forests among others. Furthermore,

Roots *et al*. has carried out estimations of bird numbers in the line transect method in 1988 (Ellermaa 2003).

Studies mentioned above have expired and therefore cannot be used when estimating the number of birds in the forests of Estonia. The sample area method that was used long ago (Palmgren 1930) has also had its shortcomings and overestimations of the number of birds could easily occur. The marginal areas are of high relative importance when it comes to small sample areas wherefore nests directly outside the area most probably are still being counted. The line transect method quite on the contrary may underestimate the number of bird species counted (Hildén 1981, Tiainen *et al.* 1980).

In the making of the Estonian bird atlas, the "average" avifauna inside one square kilometre of the forests was mapped. This enabled to show the nesting affirmation of the birds as well as (hopefully) new data of the nesting density of breeding birds in Estonia.

Study area

The sample area was located in the South-Western Pärnumaa County, 3 kilometres east of Kabli village, in the square nr. LE5030. The size of this sample square was 1 square kilometre so that the number of birds in the area would be understood uniquely - breeding pairs per square kilometre. Sample areas different from one square kilometre may provide estimations that are not integers. However, sample squares smaller than one square kilometre provide estimations that do not describe the natural bird density on a larger area at all. In those cases the part of pure chance in running across a bird is very high in many species and the interpretation of the results or the generalization may become insignificant. Originally, the location of the particular sample square was chosen randomly but later it had to be shifted west by 0, 5 kilometres otherwise the entire area would have been a 50-year-old birch grove. By shifting the area, forests of other age classes were included: clearings, young growth as well as mature forest.

The relative importance of age classes of the forests can be seen in table 1. The weighed average age of the mapped area was 30 years (between 0-80 years) and the communities consisted up to 50% of 45 – 50-year-old overmoist meadowsweet- and birch groves (according to Paal 1997). There was also a remarkable number of spruce trees (especially at the ditch sides) in the second layer of vegetation. The mature forests were moist woodlands (mixed forests of spruce and aspen, ca. 15% of the study area) and in some patches there was a drier wood sorrel type of woodland. Only very few elements of the goutweed-grove (less than 1%) and a small area of young spruce forest were present in the northern part of the study area. Clearings and young stands of birches made up about a third of the whole study area.

Tabel 1. Uuritud ala metsade jagunemine vanuseklassidesse. Pindala on hinnatud hektarites, umbes 1% täpsusega, vanus viie-astase täpsusega.

Table 1. *Areas of different forest age classes in the study area. The mean age was 30 years (weighten by area).*

Vanus (aastat) *Age (years)*	Pindala (ha) *Area (ha)*
0-5	16,0
6-10	10,0
11-20	6,0
21-30	1,0
31-40	0,5
41-50	51,0
51-60	0,5
61-70	0,0
71-80	8,0
81-90	7,0

Material and methods

In the present study the multiple mapping method was used (Koskimies & Väisänen 1988) and the study area was mapped seven times altogether. The first mapping was planned to be carried out in March but it remained only a casual one because of the large snowdrifts and the laziness of the author, but still is taken into account as the eighth mapping (the first in the sequence). In addition to the mappings, listening to the owls together with I. Tammekänd was performed. Regularly the mappings were carried out in the mornings, only once it was left to be done in the evening (Table 1). All the mappings

were carried out in dry weather conditions with no wind or just a slight breeze.

Maps in the scale of 1: 5000 were used and squares of 100 m were printed on them. In order to determine the location of the territories either GPS was used or the distance was measured by footsteps. All the areas, except the first one, were marched through in a way that the spots were passed by no further than 125 m in the forested areas and no further than 250 m in the clearings. Every time the areas were marched through in a different route.

Tabel 2. Kaardistamise ajad.

Table 2. *Dates and times of mapping.*

Kaardistuskord *No. of mapping*	Kuupäev *Date*	Kaardistamise aeg *Time of mapping*
1	26. märts/*March*	07:00-08:00
2	01. mai/*May*	04:00-09:00
3	06. mai/*May*	05:40-10:00
4	23. mai/*May*	03:30-09:00
5	04. juuni/*June*	04:30-08:30
6	10. juuni/*June*	18:45-21:45
7	11. juuni/*June*	04:00-08:30
8	02. juuli/*July*	04:00-08:00

The number of species in a sample area was estimated as follows. According to the mapping standards, the minimum number of breeding pairs in a study area (Table 3 "Min") was considered to be the number of inhabited territories that were located in the study area. When estimating the peripheral area (Table 3 "Edge") the number of territories with the middle point located i) approximately in the territory of the study area ii) immediately outside of the study area but the pairs still using the study area, were taken into account. In the first case, placing the territory into the study area would have been only the subjective decision of the author. In the second case, the territories were placed partly into the study area however the actual location of the nest being obviously outside of the borders. Estimating the maximum, the theoretical number of territories, with the location of the middle points being or could

have been located inside the study area, was given. The estimates of the maximum include the estimate of the total number of birds as well as the estimates of the territories based on single observations (Table 3). The singing territories of the migrating birds were not taken into account when estimating the maximum. However, when making generalizations it is advisable to use the minimum estimates of the breeding pairs.

When the fieldwork was completed, a map of every single encountered bird species was drawn. Permanent nesting site was considered to be the one group of observations that included at least two observations after every fifth day. However there was one nesting site of a hazel grouse that was based on only one observation (a local species).

Results

The inhabited nesting sites listed by species are presented in table 3. These are mainly breeding territories but the presence of unpaired male birds or the pairs that have interrupted the breeding cannot be excluded from the data. Besides this, differences in the biology of the species have to be taken into account as well. For example at least one male wren (*Troglodytes troglodytes*) was occupying two territories and on both of these could have been females present. In a couple of areas the singing of two male dunnocks (*Prunella modularis*) was recorded very close to one another and these males could have been the mates of one and the same female. According to the mapping standards, 336 breeding territories of 40 different bird species were registered on the whole study area. In case the territories located at the edges of the study area and the possible territories on one of the study areas would also be taken into account as well, 43 species and 418 breeding territories in maximum could have been present. The actual number of territories in the study area is probably between these two.

Tabel 3. Liikide arvukus proovilapi sees. **Min** – pesitsusterritooriumide arv/ pesitustihedused (paari/km²) kaardistusmeetodi standardi kohaselt. **Serv** – pesitsus-territooriumite arv, mille kese asus umbes proovilapi välispiiril või sellest väljaspool. **Max** – osaliselt subjektiivne tõlgendus selle kohta, mitu pesitsusterritooriumi võis asuda proovilapi sees – sisaldab ka territooriume, mis põhinesid vaid ühel vaatlusel.

Table 3. *Numbers of breeding pairs in the study area.* ***Min*** *– minimum estimate of breeding pairs/breeding densities (pairs/km²) in the study area, according to the standardized mapping method (Koskimies & Väisänen 1988).* ***Edge*** *– estimate of breeding pairs whose territories were located on the borders of the study area and the nesting sites probably outside the study area.* ***Max*** *– maximum estimate of breeding pairs in the study areas, some of them are derived by subjective interpretation of the author.*

Liik *Species*	Min *Min*	Serv *Edge*	Max *Max*	Liik *Species*	Min *Min*	Serv *Edge*	Max *Max*
Anas platyrhynchos	1	0	2	*Sylvia communis*	7	0	7
Bonasa bonasia	2	0	2	*Phylloscopus sibilatrix*	7	0	7
Buteo buteo	0	2	0	*Phylloscopus collybita*	30	9	42
Gallinago gallinago	2	0	3	*Phylloscopus trochilus*	50	1	57
Scolopax rusticola	2	0	2	*Regulus regulus*	13	0	16
Tringa ochropus	0	1	0	*Muscicapa striata*	1	1	3
Columba palumbus	3	2	6	*Ficedula parva*	4	0	4
Cuculus canorus	1	1	1	*Ficedula hypoleuca*	2	0	4
Strix uralensis	1	1	1	*Parus palustris*	0	1	0
Picus canus	0	0	1	*Parus montanus*	3	2	5
Dryocopus martius	0	1	0	*Parus cristatus*	1	2	1
Dendrocopos major	2	2	4	*Parus major*	6	2	9
Picoides tridactylus	1	0	1	*Sitta europaea*	1	1	2
Anthus trivialis	19	0	20	*Certhia familiaris*	3	0	5
Troglodytes troglodytes	8	2	10	*Oriolus oriolus*	1	0	2
Prunella modularis	11	3	16	*Lanius collurio*	0	0	1
Erithacus rubecula	27	2	30	*Garrulus glandarius*	2	1	3
Turdus merula	7	1	9	*Nucifraga caryocatactes*	1	1	2
Turdus philomelos	9	2	12	*Corvus corax*	0	1	0
Turdus iliacus	1	1	2	*Fringilla coelebs*	63	2	70
Locustella fluviatilis	1	0	3	*Carduelis spinus*	4	1	5
Hippolais icterina	0	0	1	*Carpodacus erythrinus*	3	0	5
Sylvia atricapilla	9	0	10	*Pyrrhula pyrrhula*	1	0	3
Sylvia borin	25	1	27	*Coccothraustes coccothraustes*	1	2	2

Discussion

Generalization of the results.

The mapped area is reflecting the avifauna and its structure at least of the young and moist woodlands in South-East Pärnumaa County. All the breeding territories of the wood warblers (*Phylloscopus sibilatrix*), the pied flycatchers (*Ficedula hypoleuca*), the red-breasted flycatchers (*Ficedula parva*) and the common treecreepers (*Certhia familiaris*) were located in the forests that were more than 70 years old. There were no forests present between 60 and 70 years on the study area wherefore it is not possible to estimate the importance of these forests to the species mentioned before. The younger forests were mainly cleared birch groves wherefore at least wood warblers, red-breasted flycatchers and common treecreepers could have been absent from there because of the unsuitable vegetation or some other ecological factors. There were no blackcaps (*Sylvia atricapilla*) present in the forests under the age of 30 years. The high rate (up to 70 pairs per one square kilometre) of this particular species in the 10- 30-year-old birch groves suggested by Vilbaste (1958) was obviously false (probably mistaken for the garden warbler (*Sylvia borin*) which can be found in large numbers in young growths).

The results of this study suggest that the species in the forests of Estonia whose density is only one breeding pair per square kilometre or even less cannot be extrapolated to a larger area using this method. At least the ural owl (*Strix uralensis*) (the density estimation by the author is 1PT / 4-5 square kilometres and is based on the fieldwork that was carried out in the surroundings of the study area in the same season), the three-toed woodpecker (*Picoides tridactylus*) and supposedly also the nutcracker (*Nucifraga caryocatactes*) belong to this category mentioned above.

The number of species is fluctuating from year to year. When extrapolating the estimates to a larger area it must be taken into account that the species might have been more numerous or altogether fewer in number in the corresponding year. According to the author, there were fewer bullfinches

(*Pyrrhula pyrrhula*) and garden warblers in the year 2005 than there are usually.

Optimal proceedings of the counts.

The appropriate size of an area to be mapped is 40-70 hectares during one morning, depending on the landscape (Koskimies & Väisänen 1988). In this study 100 hectares were mapped during a single count (about 20 hectares per hour). An area of that size is reasonable in the early spring, when there are still few migratory birds yet however an area of 50 hectares would be more optimal later on. The large number of clearings (there is no need to pass through the clearings very frequently), the tight network of paths through state forests and the use of GPS make the counts faster and easier. On the results of the present study it appears that the optimal speed for mapping woodland area is 10-hectares per hour. Generally it would be advisable to decrease the mapping speed 3 to 4 hours after sunrise by half since there is a steep decrease in the activity of the birds at that time. This suggested speed for counting is appropriate only for an experienced fieldworker who in addition to the songs also recognizes most of the calls and warning sounds of the birds.

The number of counts in a forested area is suggested to be 8-10 (Koskimies & Väisänen 1988). These counts have to take into account the arrival of the migratory species. The results of this particular study are based on an eightfold mapping. Koivula and Yrjölä (2004) have pointed out that there can be a big difference between a fivefold and a tenfold count when counting birds that are numerous in an area. They have observed that the territories of song thrushes (*Turdus philomelos*), tree pipits (*Anthus trivialis*), robins *(Erithacus rubecula)* and willow warblers *(Phylloscopus trochilus)* can easily be determined in a fivefold mapping. The latter species sing quite actively during the entire breeding season and they can also be easily located by other sounds. Quite on the contrary, the number of redwings, tree pipits (*Anthus trivialis*), dunnocks, common treecreepers and wood warblers is highly underestimated in a fivefold count. In the present study a similar difference in the activity of these birds was observed. An eightfold count

seemed not to be enough when counting bullfinches, goldcrests (*Regulus regulus*), dunnocks, common treecreepers and tits – an additional count would have been necessary in the middle of April (see also table 2). An additional mapping, on the 20th of June would have been necessary also for several migratory birds that arrive very late in spring, for example 60% of blackcaps and golden orioles (*Oriolus oriolus*) arrived to the territories not until June (the observation of the author).

The recommended number of counts according to the author as well as to the literature is 10 when estimating the number of forest birds. The mapping speed or area should be decreased when carrying out eightfold or even less mappings so that there would be enough observations from as many territories as possible. The schedule for fieldwork should proceed from the first mapping and the first mapping in its turn should proceed from the progress of spring – the first mapping of the author in the year 2005 was carried out too early because of the late spring. The general rule concerning the first mapping could be the time when blackbirds (*Turdus merula*) arrive to their territories, usually in the beginning of April. Too long breaks between successive mappings may cause difficulties in the estimation of species that have only a short singing period on one territory, have a hidden lifestyle and if there is usually no other evidence of their presence besides their song. Such a species occurred in the present study as well, being river warbler (*Locustella fluviatilis*). The optimal interval between successive mappings in a forested area would be 8-10 days and not more.

LINNULIIKIDE ASUSTUSTIHEDUSED MAJANDATAVAS LAANEMETSAS EDELA-PÄRNUMAAL

Kokkuvõte. Pärnumaal Kablis kaardistati 2005. a. kevadel metsalinde standardmeetodil ühe ruutkilomeetri suurusel alal. Eesmärgiks oli tuvastada n.ö. "keskmise" metsa lindude tõelähedasi asustustihedusi. Uurimisala hõlmas peamiselt eri vanuseklassist liigniiske laanemetsa kasvukohatüüpe. Käesolevas töös kirjeldatakse täpsemalt uurimisala kooslusi ja nende pindalasid. Loendusmeetodina kasutati kaheksakordset kaardistamist. Töö eesmärgiks on täpsemalt kirjeldada kasutatud loendusmeetodit ning uurida selle kaardistusmeetodi sobilikkust Eesti metsamaastikus. Vaadeldud 1 km² alalt loendati kokku 40 linnuliigi 336 pesitsusterritooriumi.

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