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Requirements by the Great Spotted Woodpecker *Dendrocopos major* for a suburban life

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Abstract

The Great Spotted Woodpecker *Dendrocopos major* has expanded its habitat range to include suburban areas in Sweden. This range expansion may affect entire communities of hole-nesters by proficient excavation of nest holes. Numbers, habitat and nest site selection were studied in a 3 km^2 suburban area in south-central Sweden during the years 1983-91 and in several forest landscapes without houses. Densities were much higher in various habitats within the suburban landscape but in such areas woodpeckers preferred to nest in woodland areas that were fairly distant from houses and in large trees. Nest heights and the number of nest holes per tree increased with distance from houses, while the proportion of Aspens among nest trees decreased with distance from houses. Aspens still dominated strongly among nest trees. The proportions of new nests and trees with single nests were lower in the suburban area than in remote forests. It is concluded that nest sites, and possibly breeding densities, are constrained by the few old or decaying trees left when new housing areas are built. Retainment of old trees and different-sized young Aspens would promote higher densities of woodpeckers and other hole-nesters and maintain a high diversity of hole-nesting species.

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Introduction

Most woodpeckers are specialized birds requiring old forests or other particular habitat features (Short 1982). However, the Great Spotted Woodpecker *Dendrocopos major* is a fairly generalized species that commonly occurs in modern managed forests (Haftorn 1971). It is often seen at bird-feeders at villages and in suburban areas during winter and has started to breed in such environments.

The Great Spotted Woodpecker is just one among a large number of bird species that recently have populated environments strongly affected by man. However, this species should be of special concern as it functions as a keystone species for many hole-nesting animals; it usually excavates a new nest hole each year and thus provides other species with a scarce and often limiting resource.

In order to understand its influence on the suburban animal community, its density there relative to those found in natural habitats should be known, as well as factors limiting its breeding numbers in the new habitat. Such factors may be human or human-related disturbance or amount of suitable habitat or nest trees. The frequency of new nests is also important for its role as a keystone species.

The objectives of this study were thus: 1) to compare numbers of Great Spotted Woodpeckers in a suburban area and those found in various types of more natural habitats, 2) to establish preferences (or tolerance) for habitats and tree species in the suburban environment and 3) to assess the proportions of new nests excavated in various suburban habitats.

Methods

The number of breeding Great Spotted Woodpeckers was censused each spring during the years 1983-91 in a 3 km^2 suburban area in the southern part of the city of Uppsala in south-central Sweden. This suburban area is located in a landscape with forests, wooded pastures and abandoned agricultural land. The human habitations include both small single-family houses with gardens and multi-storeyed blocks without gardens. Many houses in the study area were built during the 1970s.

Woodpecker densities in this suburban area were compared with densities in three other landscapes in the same region. Regular bird censuses (line transects) were performed in the springs of 1980-91 in a 5 km^2 forestry area with mature but fairly dry and poor pine-spruce forest and many clearcuts (Hansson 1983). Territory mapping of birds was performed in 1982-84 on four wooded 'islands' in agricultural land (Hansson 1986) and the total area surveyed, including similar-sized adjoining fields, was then c. 2 km^2. Finally, a landscape very similar to the suburban study area in size and habitat composition, but without houses and situated across a river valley, was examined for woodpeckers in 1988-90.

Nests were located from the begging-calls of the young at almost daily inspections from late May and throughout June. Habitat, nest tree species, tree diameter at breast height (DBH), age and height of nest hole and total number of nest holes were established at each discovery of an occupied nest. New nest holes could be easily distinguished from old ones by fresh wood-chips at the base of the nest trees. Nesting habitats were classified as (mainly coniferous) forest (more than 25 m from an edge or a house), forest edge, built-up area (maximally 25 m from a house) and wooded pasture. Nests were positioned on a map of the area and distances to the nearest building were estimated.

Using a coordinate system covering the whole study area, random locations for possible woodpecker nests were plotted on the same map from a table of random numbers. These locations were visited and habitat and tree composition were established. The woodpeckers did not breed in trees with a DBH less than .25 m, so all trees of at least this size were counted at the random points in 50 x 10 m areas, located in a north-south direction inside habitats but parallel to edges. For each year, the same number of actual and random nest sites were examined.

Results

The number of breeding pairs in the 3 km^2 suburban area varied between 5 and 11 (Fig. 1), i.e. by a factor of c. 2. There was no clear trend with time and the peak number was recorded in 1990, after an unusually mild winter. In addition, 1-2 breeding pairs of Green Woodpeckers *Picus viridis* were annually found within the study area.

No single breeding Great Spotted Woodpecker was found in the clearcut-dominated forestry area during the years 1980-91 and observations were also scarce in winter (cf. Hansson 1983). One Great Spotted Woodpecker nest was found in a forested 'island' in the agricultural landscape in 1983 but the density was still much lower than in the suburban area. No nest could be found in the equivalent landscape across the valley but one pair of anxious adults were observed in 1989 and 1990 and might have bred just outside the area censused. In summary, Great Spotted Woodpecker densities were much lower in managed forests than in the suburban area during the years 1983-91.

The distribution of habitats used by the Great Spotted Woodpecker for nesting in the suburban area (Table 1) differed significantly ($G = 15.81$, $P < 0.001$) from the

Table 1. Distribution of Great Spotted Woodpecker nests in various suburban habitats and the gross distribution of habitats according to a random nest distribution. See text for definitions of the habitats.

Fördelningen av större hackspettens bon på olika biotoper i och kring bostadsområden jämfört med en slumpartad fördelning. De olika biotoperna beskrivs i texten.

Habitat distribution *Biotop*	Actual nests *Verkliga bon*	Random *Slumpad fördelning*
Closed forest *Sluten skog*	27	12
Forest edges *Skogskanter*	19	12
Wooded pastures *(Skogs)betesmark*	4	6
Around houses *Vid hus*	16	36

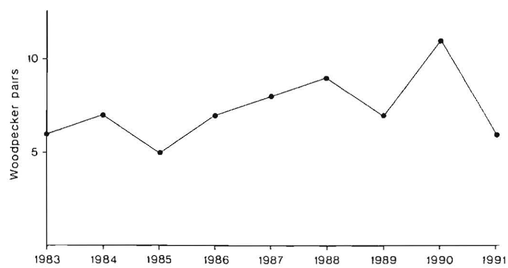

Fig. 1. Numbers of breeding Great Spotted Woodpeckers in 1983-91 in a 3 km^2 suburban area in southern Uppsala, south-central Sweden.

Antal häckande par av större hackspett under 1983-91 i ett 3 km^2 stort, delvis skogsbevuxet, område med bebyggelse i södra delen av Uppsala.

gross composition. There were comparatively more nests in forest and fewer in built-up areas.

Distances between nest and houses were compared between years by one-way analysis of variance. There was no year effect (F = 1.15, NS) so the different woodpecker densities did not affect the distributions of nest holes. The distances between houses and nest holes were significantly larger than between houses and the random points (t = 4.61, P < 0.001) so a close neighbourhood of houses was not attractive to the woodpeckers at breeding time. Woodpecker nests were, on average, located 139 m from the nearest house while the random points were, on average, 62 m from houses.

Nest height increased significantly with distance from houses (r = 0.35, n = 65, P <0.01). This height was obviously related to the sizes of the trees as height of nests also increased with DBH (r =0.33, n = 52, P < 0.05). However, DBH and distances were not correlated (r = -0.07). Thus, partial correlations between nest height and distance (r = 0.40, n = 65, P < 0.001) and DBH (r = 0.35, n = 52, P < 0.05) were both significant.

Aspen *Populus tremula* was the most common nest tree and contained more than half of the total number of the fresh nest holes (Table 2). However, the proportion of occupied nest holes in aspen and other tree species differed between the habitats (G = 9.03, df = 2 (forest edge and wooded pasture pooled), P < 0.05), with comparatively more other tree species being used in the forest. All nest trees were alive but pines and spruces used for hole excavation showed signs of weakness (decay level 2 on the scale by Hågvar et al. 1990).

The total density of trees with DBH > 25 cm did not differ significantly between the various habitats, probably to a large extent due to great differences within habitats (Table 3, F = 0.95). Within separate tree species, only Birch *Betula verrucosa* differed clearly in occurrence (F = 4.59, P <0.01), with highest density in the pasture and the lowest around buildings. Spruce *Picea abies* also showed a tendency for habitat differences (F = 2.24, P = 0.09), with the highest density in closed forest. However, Aspen made up a very small proportion of the large-sized trees in all habitats (9 % as a mean) and the woodpeckers thus showed a very strong preference for Aspen, especially around houses.

Out of 46 nest holes examined with regard to age, 33 (72 %) were made during the present spring. A G-test of the distribution of new and old nest holes between habitats revealed no differences. The number of new and old nest holes in occupied trees varied between 1 and 15. Out of 60 nest trees, 31 (52 %) contained only one hole. There was no significant difference in the number of nest holes per tree between Aspen and the other tree species. The number of nest holes per occupied tree was weakly (r = 0.25, n = 52, P = 0.07) related to the distance to the nearest building.

Table 2. Distribution of nest trees in the various habitats.

Fördelningen av boträd på de olika biotoperna.

Tree species *Trädart*	Forest *Skog*	Edge *Kant*	Pasture *Beten*	Houses *Hus*
Populus tremula Aspen, *Asp*	13	16	2	14
Betula verrucosa Birch, *Vårtbjörk*	5	0	2	1
Picea abies Spruce, *Gran*	5	0	0	0
Salix caprea Sallow, *Sälg*	2	2	0	1
Pinus sylvestris Pine, *Tall*	2	0	0	0
Quercus robur Oak, *Ek*	0	1	0	0

Table 3. Mean number of trees per ha in the different habitats. Trees of all species with DBH > 0.25 m were censused in random 50 x 10 m quadrats.

Medeltäthet av träd per ha i de olika biotoperna. Träd av alla arter med en minsta diameter om 0.25 m i brösthöjd räknades i slumpmässiga ytor om 50 x 10 m.

Tree species *Trädart*	Forest *Skog*	Edge *Kant*	Pasture *Beten*	Houses *Hus*
Populus tremula Aspen, *Asp*	8	15	7	8
Betula verrucosa Birch, *Vårtbjörk*	20	33	47	9
Picea abies Spruce, *Gran*	42	7	27	18
Salix caprea Sallow, *Sälg*	1	13	17	2
Pinus sylvestris Pine, *Tall*	47	28	17	42
Other species *Övriga arter*	0	3	0	4

Discussion

Suburban habitats, including forests close to houses, had much higher woodpecker densities than forest areas uninfluenced by human habitations. There was no evidence of interactions between Man and woodpecker during the breeding period, or during the summer months of the year, so the attraction to a suburban area is probably only related to the winter feeding. Instead, woodpeckers evidently avoided the very close neighbourhood of humans (or their cats?) when selecting a nest site. Similar distributions have been observed in passerines relying on winter feeding by humans (Hansson 1986). Both cases can be considered as edge effects due to spatial restriction of resources for winter survival.

The suburban woodpeckers used trees with similar DBH as in close forests (Hågvar et al. 1990). The mean nest heights in the suburban forest (5.3 m) and at houses (4.3 m) were at the centre and lower end of values reported for Norwegian forests by Hågvar et al. (1990).

The woodpeckers preferred to nest high up in trees of considerable size, to some extent independently of tree species. They either chose from a wider variety of tree species far from houses or Aspens close to houses. Many bird species prefer to nest as high as possible in trees, presumably to avoid predators (Nilsson 1984). However, the fairly few woodpeckers that nested very close to houses evidently had to use soft-wooded Aspens. The reason seems to be that old, more or less decaying trees of various species had been removed when the houses were built, leaving healthy and rapidly growing trees, e.g. Aspens, which had, or soon attained, the DBH needed by the woodpeckers. However, the selection of fairly young, growing Aspens obviously meant that the Woodpeckers had to excavate their nest holes, on average, at a lower height.

These findings raise the question if Aspens were originally preferred to the same extent as they presently seem to be in strictly managed forests (Aulén 1988, Hågvar et al. 1990), and evidently also in suburban environments. Wesołowski & Tomiałojć (1986) found that only 30 % of the nests of the Great Spotted Woodpecker in a primeval Polish forest were in Aspens. Breeding densities were also higher in deciduous than coniferous parts of that forest, indicating that Swedish forests, under present day methods of management and lacking the successional late deciduous phase (Esseen et al. 1992), keep Great Spotted Woodpecker densities below their potential level, as also concluded by Nilsson (1979).

Of the suburban Great Spotted Woodpeckers 28% were breeding in old nest holes compared with 15 % in more remote forests (Aulén 1988). Also this observation may indicate that trees close to houses are less suitable than trees in more or less natural forests. Hågvar et al. (1990) found 71 % single nest cavities per tree in forests against 51 % in the present study. New and single nests generally seem to be preferred by hole-nesters in order to avoid predators that memorize earlier breeding locations (e.g. Sonerud 1985, Nilsson et al. 1991).

Use of the Great Spotted Woodpecker excavations by other species was not quantified, but breeding by Blue Tit *Parus caeruleus*, Nuthatch *Sitta europaea* and Starling *Sturnus vulgaris* was observed. The old softened trees make nest excavation fairly simple and many nest holes suitable for other species may successively be produced in such trees. It is unclear if a woodpecker pair only has a single nest hole or if, when suitable trees are available, they also excavate special holes for night or winter protection. Different holes in the same tree will probably be occupied by different species due to territorial limitations within species. Widely dispersed Aspen nest holes may instead all be occupied by individuals of one particular species that breeds early or is otherwise competitively superior to other hole-nesting species. Thus, nest construction in old trees may lead to greater community diversity than single holes in younger trees.

Both the density of Great Spotted Woodpeckers and the effects of this species as a keystone species appear to increase by suitable management. The single most important measure would be to retain old and decaying trees in built-up areas. Protection of fairly young Aspens may also cause a general increase of bird density, as new trees will be continuously made available for the Great Spotted Woodpecker.

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Sammanfattning

Större hackspettens Dendrocopos major *krav för att häcka i bostadsområden.*

Större hackspetten har under senare tid börjat uppträda i bostadsområden eller, med ett mera internationellt uttryck, i suburbana miljöer. Den ses där mest vintertid vid fågelborden men bon påträffas numera också nära hus. Den är inte ensam om detta nya biotopval bland fåglarna men denna art kan visa sig ekologiskt speciellt betydelsefull då den hackar upp bohål som senare kan användas av andra fågelarter och även av andra djur. Den kan därför betecknas som en nyckelart för trädhålsberoende djur.

Det är i detta sammanhang av speciellt intresse att jämföra häckningstätheterna i suburban miljö med de i mera ursprungliga biotoper, att se vilka krav arten har på häckningsmiljöer och häckningsträd i sådana områden och att fastställa proportionen nya bohål i de olika delbiotoperna kring bostäder och andra hus. Antalet häckande par fastställdes därför i ett bostadsområde om 3 km^2 i södra Uppsala, i ett 5 km^2 stort skogsbruksområden med omfattande kalhyggen utanför Uppsala, i ett 2 km^2 jordbruksområde med stora (10 - 25 ha) skogsklädda åkerholmar och slutligen i ett 2-3 km^2 måttligt utnyttjat skogs- och betesområde fritt från hus men f.ö. mycket likt Uppsala-stadsdelen. I det suburbana området urskiljdes fyra delbiotoper: sluten skog, skogskanter, delvis skogsbeväxt betsmark och områden högst 25 m från bebodda hus ('bebyggelse' i inskränkt mening). Bon spårades nästan dagligen under slutet av maj - juni genom att lokalisera de högljutt tiggande ungarna. Biotop, boträdsart, träddiameter i brösthöjd, bohålets ålder (nytt eller gammalt) och totalt antal bohål i det utnyttjade trädet noterades. Den verkliga fördelningen av nyttjade biotoper och trädarter jämfördes med den totala sammansättningen i undersökningsområdet. Den senare erhölls genom att inventera 50 x 10 m-ytor som utvaldes med slumptal ur ett koordinatsystem som täckte hela undersökningsområdet.

Antalet häckande större hackspettspar i det suburbana området varierade mellan 5 och 11 under undersökningsperioden 1983-91 (Fig. 1). Där förekom dessutom 1-2 par gröngölingar. Det häckade ingen större hackspett alls i det hårt utnyttjade skogsbruksområdet. Ett större hackspettpar häckade på en åkerholme under ett av de fyra undersökningsåren i jordbrukslandskapet. Skoglandskapet som liknade det suburbana området i struktur och skötsel höll högst ett par under de två undersökningsåren. Det suburbana området, som var skyddat mot skogsbruk, uppvisade alltså mycket högre tätheter än de flesta mer eller mindre hårt utnyttjade skogsmiljöerna.

I det suburbana området föredrog de större hackspettarna att häcka i sluten skog och undvek bebyggelsen (Tabell 1). Bona låg också längre från hus än slumpmässigt utvalda punkter. Bohöjden ökade med avståndet från hus och också med trädens diameter i brösthöjd. Aspen var det både absolut och relativt sett mest utnyttjade trädslaget (Tabell 2 och 3). Det nyttjades mera intensivt nära bebyggelse än i den slutna skogen. 72 % av alla bon hade tillverkats under häckningsvåren. Proportionen nya och gamla bohål och antal bon per träd varierade inte mellan trädslag eller biotoper. Antalet bohål per träd visade dock en tendens att öka med avstånd från hus.

Den höga hackpettstätheten i suburban miljö bör antagligen betraktas som en kanteffekt åstadkommen genom utfodringen vintertid. Hackspettarna syntes ointresserade av husens närmaste omgivning sommartid. Liknande observationer har gjorts på diverse övervintrande tättingar (Hansson 1986).

Även om boplatsvalet liknade det i allmän skogsmiljö (Hågvar m. fl. 1990) så föredrog spettarna att häcka högt och tämligen långt från husen. De valde antingen höga lägen från ett flertal trädarter långt från husen eller häckade lågt i stora aspar nära husen. De föredrar uppenbarligen hög bohöjd för att undvika rovdjur (se bl.a. Nilsson 1984) men har ofta inte denna valmöjlighet nära hus där gamla fallfärdiga träd har tagits bort i samband med husbyggandet. Likaledes häckade fler spettar i gamla bon i det suburbana området än i riktig skogsmiljö (se Aulén 1988) p.g.a. begränsat trädurval, något som också kan leda till ökad predation (Sonerud 1985, Nilsson m. fl. 1991).

Man kan fråga sig om aspen verkligen ursprungligen var ett så prefererat träd som synes framgå av undersökningar i väl skötta skogar och som här just intill bebyggelse. Uppenbarligen hålls större hackspetten vid en artificiellt låg nivå i många kulturskogar och även i välskötta fritidsområden, något som också påpekats av Nilsson (1979). Om gamla träd bevarades vid bebyggelse så skulle man troligen få många hackspettbon per träd. Möjligen tillverkar hackspettarna fler bon än för häckning, t.ex. för övernattning. Olika djurarter skulle utnyttja samma träd på grund av territorialitet mellan artfränder och bevarandet av sådana träd skulle leda till ökad diversitet. Bevarande av relativt unga aspar med stora inbördes avstånd kan också leda till ökad förekomst av hackspettar och av dem beroende hålhäckare men under sådana omständigheter skulle i stället främst vissa konkurrensstarka arter gynnas.