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Nesting habitats and egg predation in Swedish Black Grouse

Rolf Brittas and Tomas Willebrand

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During 1984–87, nesting habitats of 72 radio-marked Black Grouse *Tetrao tetrix* were studied at Boda in central Sweden. There was a marked preference to place nests in younger stands (trees 0.5–3.0 m) compared to mature and maturing forests. Egg predation was significantly lower in the preferred stands than in stands with trees > 3.0 m. We found no difference in selection of nesting habitat between older birds and yearlings, despite a large age-related difference in breeding success earlier reported for the hens in this study. Total cover at nest sites varied considerably, but we found no relationship between cover and egg predation.

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Introduction

Black Grouse *Tetrao tetrix* are polygynous and the cock does not aid the hen during incubation and the rearing of the brood (Glutz von Blotzheim et al. 1973). In summer, Black Grouse are associated with the early successional stages of the boreal forest (< 30 yr) (e.g. Seiskari 1962, Börset and Krafft 1973, Kolstad et al. 1985). Habitat use by woodland grouse has received a lot of attention in recent years but few studies have looked at birth and/or death rates in different habitats. An earlier review of the literature indicated that nest losses of Capercaillie *Tetrao urogallus* and Black Grouse have increased in recent decades (Storaas and Wegge 1985), and it was proposed that habitat changes caused by modern forestry might make nests more vulnerable to predation.

In a recent study of Black Grouse, Willebrand (1988) showed that yearling hens fledged fewer young than older birds (≥ 2 yr). This paper describes the habitat of 72 nest locations from that study. We compare habitat preference of yearlings with that of older birds, as well as nest predation in different habitats.

Study area

The study was done during 1984–87 at Boda, Sweden (61°N, 16°E) at the border between the southern and middle boreal zone (Willebrand 1988). The study area (32 km²) is characterized by intensively managed forest, with 42% of the stands less than 20 yr old. The dominant tree species were Scots pine *Pinus silvestris*, Norway spruce *Picea abies* and birch *Betula* spp. (52%, 38%, and 10% respectively), and the dominant ground vegetation was bilberry *Vaccinium myrtillus*, heather *Calluna vulgaris*, and wavy-hair grass *Deschampsia flexuosa*.

Methods

Hens were caught on leks or in snow burrows and fitted with a necklace transmitter (see Willebrand 1988). Nests were found by carefully flushing the incubating hen after she had been inactive for more than 5 min twice at the same position. Ten of the 72 nests found were re-nests.

Table 1. Locations of Black Grouse nests on the Boda study area in relation to different categories of forest stands.

Forest stands	Proportion of observations (%)	
	Observed (n=69)	Expected (n=330)
Clearcut	8.70	6.36
Thicket	37.68***	14.24
Young	27.54	21.52
Maturing and mature	8.70***	46.66
Bog	7.25	3.94
Other stands	10.14	6.96

*** $P < 0.001$

Habitat recordings were made 1–2 d after hatching. We described the habitat in detail (Marcström et al. 1982) within a circle with a diameter of 20 m around each nest. Species composition and extent of cover in the tree-layer (> 3 m), shrub-layer (< 3 m) and field-layer were recorded. We measured the height of the canopy, and estimated the proportion of ground covered (total cover) by branches, shrubs and field-layer at 30–100 cm above ground. The field-layer was categorized according to the type of vegetation (Hägglund and Lundmark 1977).

The different forest stands within 100 m of the nests were recorded, and categorized as (a) clearcut: clearcuts and young plantations with seedlings < 0.5 m; (b) thicket: stands with trees between 0.5 and 3 m; (c) young: stands with trees > 3 m and diameter at breast height < 10 cm; (d) maturing: stands with a tree diameter at breast height between 10 and 20 cm; (e) mature: stands with a tree diameter at breast height > 20 cm; (f) mixed-aged stands; (g) forested bogs; and (h) open bogs. The number of stands or areas with marked differences in soil moisture within 50 m in four perpendicular directions were recorded. Estimates of site quality were obtained from forestry stand descriptions, providing an index (16–27) of tree-growth per 100 years.

The habitat throughout the study area was sampled at 330 grid-points (250×400 m). We used χ^2 to test for goodness of fit, and adjusted z statistics to the Bonferroni normal statistics (Neu et al. 1974) when several parameters were estimated simultaneously.

Results

Habitat features at nest sites did not differ between yearlings and older birds ($\chi^2 \leq 3.70$, $P \geq 0.22$, 1–3 df). Data from the two age groups were therefore pooled in further analyses. The positions of nests suggest a marked preference for thicket stands ($P < 0.001$) while mature and maturing forests were apparently avoided ($P < 0.001$) (Table 1). Nests were found as often as expected in young stands (trees > 3.0 m). Total ground

cover was less than 20% around 33% of the nests, but exceeded 60% around 22% of the nests. Hens re-nested in a different type of stand from that used during the first nesting attempt on 7 out of 10 occasions, and individual hens changed stand type from the previous year in 4 out of 8 instances.

We then compared the nest ($n = 51$) and grid ($n = 140$) sites in younger successional stages (clearcut, thicket and young stand). There was a strong preference for slopes compared with flat areas ($P < 0.001$), and a tendency to prefer nest sites with a low (0–10%) cover of grass ($P < 0.10$). The herb categories on rich soil were avoided ($P < 0.001$), while hens tended to prefer the bilberry category ($P < 0.10$). There was also a preference for nesting in places of moderately high site quality, with scores between 22 and 24 ($P < 0.05$), and with low (0–10%) cover of herbs ($P < 0.05$).

Egg predation was more common in young stands than in clearcuts and thicket stands, 11 of 18 vs 6 of 24 nests ($\chi^2 = 5.57$, $P < 0.02$, 1 df). It is noteworthy that none of the 12 nests in the bilberry category were destroyed (Table 2).

Discussion

There was no difference in habitat features between nest sites of older birds and yearlings despite a large difference in breeding success (Willebrand 1988). More older birds than yearlings managed to hatch a clutch but this was in part explained by a higher tendency for older birds to re-nest. However, an age-related difference in habitat use may be more obvious during egg-laying and rearing of broods.

The strong tendency to nest in thicket stands differs from the findings of Storaas and Wegge (1987). They found that both Capercaillie and Black Grouse nested in a wide range of habitats, and that clutches survived equally well in all habitats. In our study, a higher proportion of nests were destroyed by predators in the less used habitat than in the preferred stands (clearcut and thicket stands). From this, nest predation was least in the successional stages that Black Grouse generally prefer during summer. A possible explanation of the differ-

Table 2. Numbers of Black Grouse nests that hatched or were destroyed in different vegetation categories.

Category	Hatched	Destroyed
Low herb	4	2
Grass	8	11
Bilberry	12	0
Cowberry and crowberry-heather	6	5
Other	2	2

ence between these two sets of results is that the proportion of young stands in our study area was higher than at Varaldskogen where Storaas and Wegge worked. Intensive forestry and clearcutting have been practiced for a long time in our study area.

A highly specific nesting habitat could provide cues to specialized egg predators (Croze 1970). It follows that placing the nest in a wide range of habitats may be a way to reduce nest predation. However, grouse eggs are not a main food item for any predator in the boreal conifer forest (Angelstam 1983, Storaas and Wegge 1987). Willebrand and Marcström (1988) showed that carnivores (e.g. fox *Vulpes vulpes*, pine marten *Martes martes*) destroyed more Black Grouse nests than did corvids. The large variation in nest cover and the lack of relationship between cover and egg predation, as shown in this study and by Storaas and Wegge (1987), further support the importance of carnivores as egg predators compared to corvids.

We have no data on hatching success of Capercaillie, and we do not know whether young stands at Boda are poor nesting habitats for Black Grouse especially or for woodland grouse in general. Young stands at Boda have a poorly developed field-layer compared with thicket stands due to a relatively high tree density and a dense canopy cover. A short layer of mostly grass is common in the young stands at Boda. However, the composition of field-layer, tree density and canopy cover vary between different parts of Sweden. Young stands further north are more open and the field layer contains a higher density of *Vaccinium* species (unpublished data), but we lack data on egg predation in these areas. It appears as if the change in habitat from thicket to young stand increases the probability for predators to find Black Grouse nests. Higher egg predation could also be expected if young stands are used more frequently than other habitats by foxes and mustelids in their search for

microtines, thereby increasing the encounter rate of nests.

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