RESEARCH NOTES

Use of thicket stages of Scottish conifer plantations by red and roe deer in relation to openness

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Introduction

Red deer (Cervus elaphus) and roe deer (Capreolus capreolus) are widespread in Scottish plantation forests and often occur at high densities (Latham et al., 1996). They cause considerable damage to tree crops (e.g. Gill, 1992; Welch et al., 1992), and much effort is put into their control (Ratcliffe, 1987; Ratcliffe and Mayle, 1992; Latham et al., 1998). Estimation of population densities is important for deer management, and is often achieved through counts of faecal pellet groups (Mayle et al., 1999).

Thicket-aged stands of trees (15–28 years; sensu Staines and Welch, 1984) can be highly preferred by red deer and rather less so by roe deer (Staines and Welch, 1984; Welch et al., 1990). This age-class is common due to extensive planting in the 1970s and 1980s, and is likely to remain a major component of British short-length rotation forests. It therefore makes a major contribution to the habitat available to deer within forests, and must be adequately sampled when deer populations are estimated. However, the structure and ground flora of ‘thicket’ varies: if the trees grow well, thicket has a dense closed canopy and virtually no remaining ground flora; if the trees have grown poorly due to waterlogging, exposure, disease or excessive browsing by deer (‘checked thicket’), the canopy is patchy and open, and often an extensive ground flora persists (Latham, 1993). It is therefore very important that any differential usage by deer of the different forms of thicket are considered in population estimations. An extensive study of deer densities in Scottish plantation forests was undertaken in the early 1990s (Latham et al., 1996). To assist the stratification and sampling in this project, a pilot study was carried out into the deer usage of thicket-aged stands. The results of that pilot study are presented here.

Methods

The study took place in April and May of 1992 in Glenbranter and Eredine Forests in Argyll, Carron Valley Forest in Stirlingshire, and Clashindarroch Forest in Grampian, Scotland. These are large (> 1 000 ha) second-rotation mixed-aged conifer plantations predominantly of sitka spruce (Picea sitchensis) and were owned by the Forestry Commission. All thicket-aged (15–28 years) stands were identified from stock maps, and a series of 117 random points were located within them. From each point, a \(100 \times 1.5\) m transect was set out along a random compass bearing. Dung groups and the proportions of the transect under canopy and in gaps were recorded. A gap was defined as a central transect section of at least \(1\) m with no vertical...
tree cover. The proportion of the transect lying within gaps (hereafter referred to as openness) and widths of individual gaps were recorded. If a gap occurred at the end of a transect, its width was taken as the length of transect within it. Each transect was considered to represent the 1 ha block in which it lay (i.e. the transect was the width of a square 100 × 100 m), and additional transects lying within or impinging upon that hectare block were rejected.

Correlations between openness and number of dung groups per transect were investigated. The density of dung groups in gaps and under canopy were calculated for each transect and compared with openness to assess their relative usage. The relationships of gap number and mean size per transect were also investigated. Deer occurred at low overall densities (< 2.5 animal km<sup>-2</sup>) at Carron Valley and Clashindarroch (roe deer) and Eredine (red deer) (Latham et al., 1996), and have not been considered for these sites.

**Results**

Numbers of dung groups were strongly correlated with openness for all forests and for both deer species (Table 1, Figures 1 and 2). Numbers were consistently low up to around 30 per cent openness, after which they rapidly increased. For red deer at Eredine and Glen Shellish combined (their dung populations are almost identical) there was no significant correlation up to 30 per cent openness \( (r = 0.20, n = 21, P > 0.1) \), but a significant one above \( (r = 0.43, n = 41, P < 0.01) \). The range 20–40 per cent openness gave a highly significant result \( (r = 0.83, n = 20, P < 0.001) \). The roe deer data gave similar, but weaker, results.

Higher densities of dung were found in gaps than under canopy for both species and all forests \( \text{ANOVA, } P < 0.05 \text{ in each case} \). Dung density within gaps significantly increased with openness, but dung density under canopy did not (Table 1). For red deer dung densities in gaps, there was no significant correlation with openness up to 30 per cent, or from 30 to 100 per cent openness \( (r = 0.01, n = 41; r = 0.13, n = 21 \text{ respectively}) \), but a highly significant result for the range 20–40 per cent openness \( (r = 0.79, n = 20, P < 0.001) \). The canopy density data gave no significant results. The roe deer data showed a similar, but weaker, pattern.

There was a strong positive linear relationship between mean gap size and openness \( (r = 0.80, n = 114, P < 0.001) \). The number of gaps per

<table>
<thead>
<tr>
<th>Forest</th>
<th>No. of transects ( (n) )</th>
<th>Correlation between no. of dung groups and openness</th>
<th>Correlation between dung density and openness</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>( r )</td>
<td>( p )</td>
</tr>
<tr>
<td>Red deer#</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Glen Shellish</td>
<td>37</td>
<td>0.78</td>
<td>***</td>
</tr>
<tr>
<td>Eredine</td>
<td>30</td>
<td>0.69</td>
<td>***</td>
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<tr>
<td>Roe deer#</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Glen Shellish</td>
<td>37</td>
<td>0.53</td>
<td>***</td>
</tr>
<tr>
<td>Carron Valley</td>
<td>31</td>
<td>0.70</td>
<td>***</td>
</tr>
<tr>
<td>Clashindarroch</td>
<td>19</td>
<td>0.77</td>
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transect also increased with openness to about 70 per cent, but declined thereafter. Gaps coalesce as their sizes increase; openness of 100 per cent would in fact be a single large gap.

Discussion

Thicket-aged stands of conifer plantations are not homogeneous habitats for deer. Both red and roe deer increase their usage of thickets as the proportion of open space within them increases, and this needs to be taken into account in any stratification of plantation forests for deer population estimations. The data also suggest that thicket usage increases significantly when open space exceeds 30 per cent. Thirty per cent openness corresponds to a mean gap diameter of around 6 m, and it would be interesting to see if this relates to any threshold of vegetation change. Unfortunately, no records were made of gap vegetation in this study.

Latham et al. (1999) compared red and roe deer diets within the same forests used in this study. Roe deer were shown to be highly selective, favouring easily digestible items such as forbs, which were less well represented in open-thicket stages than in unplanted or recently planted ground. In contrast, red deer ingested items in broadly similar proportions to their representation on the ground in all habitats, suggesting that thicket-stage plantation may be a more suitable feeding habitat for red than for roe deer.

Acknowledgements

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