Is winter resources availability a driver of territoriality in Hazel grouse (*Bonasa bonasia*)?

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Theory predicts that territoriality evolves as a consequence of competition for limiting resources, ability of individuals to defend the resource and fitness benefit from exclusive use of the resource.
Hazel grouse (Bonasa bonasia) is a small grouse species mainly inhabiting mixed forest along the Eurasian boreal forest belt as well as in mid altitude forests in central Europe. Populations from western Europe overwinter alone or in pair and may even show a territorial behaviour. Whereas Siberian populations overwinter in flocks, without showing any territoriality. Hazel grouse is a phytophagous species feeding exclusively on buds and catkins of Betulaceae, Salicaceae and Rosaceae over winter. During this season, the species also uses coniferous trees as roosting sites to protect against predator and for thermal insulation.
In the present study, we tested the hypothesis that spatial clustering of winter resources (i.e. feeding sites and roosting trees) may favour territoriality in the species in the Swiss Prealps.
During autumn and early winter, we described qualitative and quantitative descriptors for each type of resource. We recorded the position and area of feeding sites and we also quantified the number and height of trees for each species observed at the feeding site. Roosting trees were described using foliage structure and density, trunk diameter, tree size, and canopy cover of the surrounding forest. We assigned feeding sites and roosting trees into suitability classes, based on Hazel grouse requirements, and analysed the spatial distribution of both resources.
In winter, we collected evidence of the species presence (mainly faeces) along linear transects on snow. We amplified two diagnostic microsatellite loci to detect and exclude samples from Black grouse (Lyrurus tetrix) and Capercaillie (Tetrao urogallus), two grouse species also present in the Swiss Prealps.
Within four study sites in the Swiss Prealps, we could show that overall feeding sites were randomly distributed, whereas roosting trees were clustered. We built predictive models of Hazel grouse occurrence including roosting sites or feeding trees categories alone, and combining roosting sites and feeding trees categories. We used Receiver Operating Characteristic (ROC) plot to rank models based on their performance to predict Hazel grouse occurrence. The model combining high density of roosting trees surrounded by dense canopy cover, and the availability in referred feeding resources best predicted Hazel grouse occurrence in winter. This model predicted the potential presence of Hazel grouse into small (10–50 ha) discrete patches of suitable habitat.
Our results suggest that suitable winter habitat was a limiting factor for the species and, according to theory, may favour territoriality in Hazel grouse in the Swiss Prealps.

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