

Grouping Pattern, Habitat Assessment and Overlap Analysis of Five Ungulates Species in Different Altitudinal Gradients of Western Himalaya, Uttarakhand, India

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Abstract : Grouping patterns, habitat use, and overlap studies were conducted on five sympatric ungulate species sambar (*Cervus unicolor*), chital (*Axis axis*), muntjac (*Muntiacus muntjac*), goral (*Nemorhaedus goral*), and serow (*Capricornis sumatraensis*) in the Dabka watershed area within Indian West Himalayan range. Data on age, sex composition, group size, and various ecological and topographical factors governing the presence/absence of species within the study area were collected using a 250 km of a trail walk, 95 permanent circular plots of 10 m radius, and 3 vantage points with 58 scanings. The highest mean group size was recorded for chital (6.35 ± 0.50), followed by sambar (1.35 ± 0.10), goral (1.25 ± 0.63), muntjac (1.12 ± 0.05), and serow (1.00 ± 0.00). Grouping pattern significantly varied among sympatric species ($F = 85.10$, $df = 6$, $P = 0.000$). The highest mean pellet group density (/ha \pm SE) was recorded for sambar (41.56 ± 3.51), followed by goral (23.31 ± 3.45), chital (19.21 ± 3.51), muntjac (7.43 ± 1.21), and serow (1.02 ± 0.10). Two-way variance analysis showed a significant difference in the density of the pellet group of all ungulate species across different study area habitats ($F = 6.38$, $df = 4$, $P = 0.027$). The availability-utilization (AU) analysis reveals that goral was mostly sighted in steep slopes, preferred > 2100 m altitudinal range with low shrub understory, avoided dense forest, and relatively more southern aspects were used. Chital had used a wide range of tree and shrub coverings with a preference towards moderate cover range (26-50%), preferred areas with low slope category (< 25), avoided areas of high altitude > 900 m. Sambar avoided less tree cover (0-25), preferred slope category (26-500), altitudes between 1600-2100 m, and preferred dense forest with northern aspects. Muntjac used all elevation ranges in the study area with a preference towards the dense forest and northern aspects. Serow preferred high tree cover $> 75\%$, avoided low shrub cover (0-25%), preferred high shrub cover 51-75%, utilized higher elevation > 2100 m, avoided low elevation range and northern aspects. All species occupied similar habitat types, forest or scrub, except for the goral, which preferred open spaces. Between muntjac and sambar, the highest overlap was found (65%), and there was no overlap between chital and serow, chital and goral. Aspect, slope, altitude, and vegetation characteristics were found to be important factors for the overlap of ungulate sympatric species. One major reason for their ecological separation at the fine-scale level is the differential use of altitude by ungulates in the present study. This is confirmed by the avoidance by chital of altitudes > 900 m and serow of < 2100 m.

Keywords : altitude, grouping pattern, Himalayas, overlap, ungulates

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