



When, Where, and Why Do Contacts Occur? Investigating Interactions Between Bighorn Sheep in and Around Glacier National Park

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ABSTRACT: Understanding mechanisms of social interactions can help address questions in evolutionary, behavioral, and infectious disease ecology. Trade-offs between costs and benefits of sociality can operate at multiple scales, and factors influencing sociality at one level are likely different from those at another level. We investigated contacts of 87 male and female bighorn sheep (*Ovis canadensis*) in and around Glacier National Park in Montana, USA from 2002-2011 using GPS locations. We examined relationships between contact locations, movement, and extrinsic variables (e.g., land cover, NDVI, distance to escape terrain) using a resource selection function. To assess types of contacts, we separated contacts by dyad type (male-male, female-female, and male-female) and examined the strengths of association for dyads with intrinsic variables (e.g., relatedness, space-use overlap, dyad type, and homophily) using a generalized linear mixed model. Finally, we identified subpopulations through contact networks using different distance criteria (25 - 100m). Most contacts occurred in March for same sex dyads and from November to January for male-female dyads. Although more contacts occurred in high quality habitat, contacts were more likely in lower quality habitat for same sex dyads. For male-female dyads, however, contacts occurred more and were more likely in high quality habitat. Female-female dyads with high space-use overlap during the summer, moderate relatedness, and of the same age class had highest rates of association. Different contact criteria identified 3 to 4 subpopulations. Together, these results give us the power to predict where contacts are most likely to occur, which can inform disease management.

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KEYWORDS Bighorn sheep; *Ovis canadensis*; social interactions; contacts; Glacier National Park; Montana.