# Geo-Statistical Methods For Detecting Elk Parturition Sites From Gps Collar Data

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There is an increasing awareness of the importance of juvenile survival in ungulate population dynamics, and the accurate prediction of parturition habitat may allow for more effective management. Detecting birth sites in a statistically rigorous way, however, often requires intensive field efforts that may not be possible for all studies. We developed a hierarchical two-stage clustering analysis for identifying elk parturition locations, which can

be conducted retrospectively using only GPS location data. We validated our approach using a dataset of 59 adult female elk (*Cervus elaphus*) fitted with both a Global Positioning System (GPS) collar (30-minute sampling interval) and vaginal implant transmitter (VIT)   For the top parameter set, approximately 80% of estimable parturition sites were within 1 km of their respective VIT location. Roughly 10 % of our predicted birthing locations were over 2 km away from the VIT location, but many of these events could be filtered from the analyses due to their clustering attributes. Designed to minimize Type II errors this filtering also removes a subset of birthing sites that close to VIT locations, and magnitude of this effect varied across parameter sets. Sub-sampling of the GPS dataset from 30 min to 1, 2, 3, and 6 hour intervals resulted in modest reductions in the efficacy of our approach. With the use of GPS collars in ungulate studies on the rise, our approach provides managers with additional information on birth site locations at no additional cost over and above a typical GPS study.