Assessing the Performance of the Risk of Contact Tool's Core Herd Home Range Estimator

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ABSTRACT: The US Forest Service/Bureau of Land Management's Risk of Contact Tool (RoCT) informs bighorn sheep managers by providing them with quantitative estimates of risk of contact between foraying bighorn sheep and domestic sheep and goats. The Tool implements a model originally developed for a 2010 bighorn sheep viability analysis by the Payette National Forest. That analysis was based on 13 years of mostly VHF telemetry data, collected at approximately two-week intervals from animals in 12 Hells Canyon area herds. While the Tool gives users wide latitude in their choice of inputs, several of its defaults reflect aspects of that original dataset. Advances in both animal tracking technology and modeling methodologies since the Payette analysis spurred reassessment of one of those defaults, the Gaussian reference function kernel density estimator (KDE) that the Tool uses to estimate a Core Herd Home Range (CHHR). The KDE assumes that location data are independent and identically distributed – an assumption that is violated by the high-fix-rate, highly autocorrelated location data provided by GPS collars. To remedy that issue, Silverman et al. (2015) propose using the autocorrelated KDE (AKDE), which they designed to account for the autocorrelation inherent in modern tracking data. Accordingly, we compared the performance of the KDE and the AKDE, along with two other commonly used home range estimators, the minimum convex polygon (MCP), and local convex hull (LoCoH). To compare the estimators, we used a GPS dataset consisting of locations from nearly 600 animals in 60 Nevada herds. Estimator performance was assessed at both the individual and the herd level using several forms of subsampling and cross-validation. For each home range estimate, we measured area along with coverage with respect to both in-sample and out-of-sample telemetry points. A good home range estimate is one that comes close to achieving the desired coverage (e.g. encompassing 95% of out-of-sample points) while remaining relatively small. Based on those criteria, and despite the high spatial autocorrelation of the telemetry data, the KDE estimator currently used by the Tool performs as well as, and in most aspects better than, the three alternatives we assessed.

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