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# Inference of Ruminant's Activity using GPS-based Animal Tracking Technologies

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**Abstract**

Evaluations of range-animal behaviour and its relation to resource selection have been limited by reliance on human observation with high data collection costs, radio telemetry with poor spatial precision or GPS at long logging intervals. With the recent advances in technology, it has become possible to continuously record animal positions via GPS logging at very short intervals. However, continuous logging produces enormous amounts of data which are difficult to analyse without special algorithms. The objective of this study was to develop new techniques for identifying locations where animals were stationary, classify animal movement and to relate this information to traditional behavioural activities. We designed and tested three algorithms to help not only interpret the position data but also classify animal activity. Animal with GPS collars were periodically observed during daylight hours by trained technicians who recorded the time and related activity of animals on data forms. Three algorithms were tested to separate positions into two classes, moving and stationary. Algorithm 1 identified and classified sequential points in close proximity as non-moving; Algorithm 2 searched the data for a user-defined number of positions. Mean and standard deviation of the position were calculated then sequential adjacent positions (in time) were added to the growing group as long as they were a non-significant distance from the position of the group. The computer then searched for the next best seed group. Groups were constructed until the remaining GPS points did not meet requirements for seed groups, then minimum convex polygons were created around the point clusters and an information file created that recorded group number, position, surface area, start time, end time and duration of occupancy at that location. The third algorithm examined the pattern of velocities recorded by the GPS by calculating running means over 1-minute intervals for the entire day. These algorithms were first tested on cattle and goats in eastern Oregon, then on sheep in northwestern Syria. The proposed techniques enables behavioural scientist to analyse animal spatial and temporal behaviour and resource selection at a resolution that could not be accomplished in the past without extreme investment in time and capital.

**Keywords:** Animal behaviour, GPS collars, grazing, small ruminant, spatial analysis

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