

A new methodology to estimate stocking density of grazing sheep based on distance from night pens

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Introduction: Grazing is a useful tool for the implementation of management strategies finalized to the restoration, improvement, or conservation of grassland vegetation. Many studies aiming at assessing the effectiveness of such strategies were based on indirect measures (proxies) of livestock stocking density such as distance from congregation areas (e.g. sheds, water sources), since stocking density is known to affect the consumption of plant species by animals. However, the suitability of these proxies has been rarely validated. In the Alps, sheep flocks are usually managed through lenient supervision by shepherds during day and sheltered in temporary night penning areas (TNPA). Given that TNPA are periodically moved over the pasture throughout the grazing season, the aim of our study was to implement a method using a GPS/GIS assessment to determine whether the distance from TNPA can be used as a reliable predictor of sheep stocking density at grazing.

Materials and methods: In 2015, a flock of 250 sheep grazed for one month over 45 ha of nutrient-poor dry grasslands in the Western Italian Alps and in that period it was fenced in 14 TNPA for 2-3 nights each. Ten sheep were tracked with GPS collars recording at 15-minute intervals. We assessed sheep stocking density as the number of GPS fixes within a 30 m-buffered zone around 65 randomly-generated points. We performed a linear regression analysis using stocking density within each buffered zone as response variable and the sum of inverse distances of each point from all the TNPA as explanatory variable.

Results: Our results highlighted a strong inverse correlation ($P < 0.001$, $R^2 = 0.83$) between the stocking density and the distance from TNPA.

Conclusion: This short-term experiment supported the use of the distance from congregation areas as an easy-measurable and effective proxy to predict sheep stocking density in mountain environments.

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