Predicting occurrence of Iberian wolf: the role of sample size and spatial scale

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Analysis of Iberian wolf distribution patterns is an important tool for effective management and conservation actions because it facilitates the development of guidelines for habitat protection. We hypothesized that wolf distribution patterns result from processes occurring at multiple spatial scales and therefore, key habitat factors likely varies with scale. The main goal of this study is to analyze the role of sample size and spatial scale to predict the Iberian wolf occurrence. Firstly, we collected reliable information on Iberian wolf distribution at three scales: 66 wolf locations with high spatial resolution (GPS coordinates) at local scale (Vila Real and Bragança counties, NE Portugal), 396 2x2 km squares with wolf presence at regional scale (Portugal), and 1.283 10x10 km squares with wolf presence in Iberian Peninsula. We considered three sets of variables as potential predictors of the species distribution: landscape (altitude and land use), domestic prey availability (cattle, sheep and goat density), and human disturbance (road density and human population density). Habitat models were built using Maxent method for wolf locations at local scale and Generalized Linear Models using wolf presence/absence at 2x2 km and 10x10 km squares for Portugal and Iberian Peninsula, respectively. All best models show AUC higher than 0.85 with strong variations in predictive performances when applied to other scales. The model at local scale had the highest AUC score, followed by the Portugal and Iberian Peninsula models. Portugal model was the model with the best predictive power when transferred to other wolf distribution scales. Although all three models included landscape, prey availability, human disturbance as predictor variables, landscape variables had the highest contribution. Based on our findings, we recommend the development of habitat models using high-resolution data on species distribution from a wide range of wolf areas in the Iberian Peninsula to improve the ability to predict species occurrence and areas of unoccupied suitable habitat for wolf recovery.