Olivia Guswiler / Emma Sudbeck

Lab Assignment 4

2024-10-15

We analyzed presence-absence of the Madrean alligator lizard (*Elgaria kingii*; ELKI) at 171 sites across Arizona in relation to forest, grassland, and water landcover types; precipitation; elevation; and topographic position index (TPI). We first assessed each covariate at a range of radii buffers (100-1200-m) at each site using Akaike’s information criterion (AIC) to determine respective scales of effect. All following analyses evaluated the influence of covariates at their scale of effect. We analyzed ELKI probability of presence as a function of each covariate separately using logistic regression models. Following, we modeled the probability of ELKI presence at our sites using a multi-covariate pseudo-optimized multi-scale logistic regression model. Finally, we fit a multi-covariate single-scale logistic regression model with all covariates measured at a buffer radius of 100-m. For all analyses, all covariates were z-score standardized for ease of comparison across models.

The scale of effect for each covariate are as follows: Forest, 300-m (AIC = 233.40); Grassland, 100-m (AIC = 231.23); Water, 1200-m (AIC = 237.28); Precipitation, 1200-m (AIC = 228.50); Elevation, 1200-m (AIC = 229.84); and TPI, 200-m (AIC = 202.35). The most common scale of effect across these features was 1200-m, indicating potential underestimation of the maximum buffer size for these covariates.

Evaluated separately, the probability of ELKI presence at sites showed a positive association with grassland cover (60.9%, p = 0.011), precipitation (64.1%, p = 0.0040), and elevation (61.9%, p = 0.0052) and a strong negative association with TPI (16.7%, p < 0.001). Probability of presence at sites with forest cover exhibited a positive trend (61.8%, p = 0.081), while water exhibited a negative trend (45.8%, p = 0.28), however neither effect was significant.

Assessing the combined influence of all covariates on the probability of ELKI presence revealed a positive association with grassland cover (63.6%, p = 0.0071) and a strong negative association with TPI (13.5%, p < 0.001). TPI had the strongest effect, followed by grassland and, despite a lack of statistical significance, forest cover also showed a positive trend (62.4%, p = 0.13). Differing from our single-covariate models, precipitation (52.9%, p = 0.66) and elevation (53.1%, p = 0.63) no longer held statistical significance. The effect of water land cover (53.1%, p = 0.48) remained insignificant. As previously mentioned, the lack of significance associated with these features may have been a result of the scale constraints.

*Bonus: Measure each covariate using 100-m radius buffers and fit a multi-covariate single-scale model.*

Results from the single-scale model (AIC = 198.40) did not better explain the variability of the data than the multi-scale model (AIC = 194.94), despite only minor differences in covariate effect sizes and/or significance. Grassland cover (62.5%, p = 0.013) and TPI (16.6%, p < 0.001) remained the only covariates with significant effect on probability of ELKI presence. In this single-scale model, the positive effect of grassland cover decreased only slightly and its significance reduced. The negative effect of TPI decreased but remained strongly significant.