Calculating Log Response Ratios

To quantify edge and fragmentation effects across studies, we calculated log response ratios (LRRs) using methods described by Hedges et al. (1999) within the R computing environment (v. 4.1.0; R Core Team 2021). Experimental log response ratios (LRR_i) were

$$ln\left(\frac{\bar{X}_{edge}}{\bar{X}_{int}}\right) \text{ or } ln\left(\frac{\bar{X}_{frag}}{\bar{X}_{cont}}\right) \quad (1)$$

the ratio of the mean response in patch edges ($\overline{X}_{edge}$) or fragmented landscapes ($\overline{X}_{frag}$) over the mean response in patch interiors ($\overline{X}_{int}$) or continuous landscapes ($\overline{X}_{cont}$), respectively. A positive LRR_i indicates a relative increase in response within edge or fragmented habitats versus interior or continuous habitats, respectively. Conversely, a negative LRR_i indicates the relative decrease in response within edge or fragmented habitats versus interior or continuous habitats, respectively.

Our database included a total sample size (k) of 338 unique LRR_i across the 43 studies. We pooled non-independent time or spatial replicates using methods described by Hedges et al. (1999). For experiments that presented responses to fragmentation or edge effects separated by non-independent covariate levels (i.e., replicates taken at the same location within one year), individual measurements were treated as sacrificial pseudoreplicates in the calculation of the within-experiment variance (vi) for each LRR_i. All non-independent measurements in an experiment were distilled to a single 'sample' mean ($\overline{X}_l$), equal to

$$\overline{X}_l = \frac{\sum_{i=1}^{j} n_i X_i}{\sum_{i=1}^{j} n_i} \quad (2)$$

where j is the number of non-independent replicates within an experiment, X_i is the mean, and n_i is the sample size of the ith replicate. The standard deviation ($\overline{SD_l}$) for each $\overline{X}_l$, equal to

$$\overline{SD_l} = \frac{\sum_{i=1}^{j}(n_i - 1)(SD_i)^2}{\left(\sum_{i=1}^{j} n_i\right)} \quad (3)$$

was then incorporating the within-experiment variance, v_i (sensu Hedges et al., 1999), given by

$$v_i = \sum_{l=1}^{m} \frac{(\overline{SD_l})^2}{n_l \bar{X}_l^{\,2}} \quad (4)$$

where l indicates the now independent 'samples' in the experiment, and m is the number of independent 'samples'.