Rafael X. De Camargo and David J. Currie. An empirical investigation of why species-area relationships overestimate species losses.

Appendix A: The mathematical derivation of the Lost-Habitat SAR model (LH-SAR).

In contrast to earlier work, we posit that, as landscapes are converted to human-dominated land cover, a portion of the human-dominated area is "available" and part is "lost". Lost areas could include buildings, paved areas, intensive agriculture, or other human infrastructure. Human-dominated available habitats could include recent cutovers, pastures and abandoned fields. Therefore, suppose that human-dominated cover (A_{human}) can be divided, to a first approximation, into two classes: available human-dominated (A_{Human_avail}) landscapes, which provides habitat for open-habitat species, and "unavailable human-dominated areas" (A_{Human_lost}) that is truly "lost" as avian habitat:

$$A_{Human} = A_{Human\_lost} + A_{Human\_avail} \tag{A.1}$$

Since the proportion of A_{Human} in a landscape is one minus proportion of forested areas (A_{Forest}):

$$A_{human} = 1 - A_{Forest} \tag{A.2}$$

Then the proportion of A_{Human_lost} would be:

$$A_{Human\_lost} = (1 - A_{Forest}) - A_{Human\_avail} \tag{A.3}$$

It seems reasonable to assume that, as the proportion of the landscape that is dominated by humans increases, the amount of human-dominated land cover that is inhospitable to birds would also increase. We hypothesize that A_{Human_lost} increases with human-dominated cover ($1-A_{Forest}$) following another power function:

$$A_{Human\_lost} = c' (1-A_{Forest})^{z'} \quad (A.4)$$

where *c'* and *z'* are empirical constants.

If $z'=1$, then lost habitat is a constant proportion of the amount of human-dominated cover. If $z'>1$, then lost habitat is an increasing proportion of the human-dominated cover in landscapes with progressively more human-dominated cover. If $z'<1$, then lost habitat is a decreasing proportion of human-dominated cover in landscapes with progressively more human-dominated cover. Combining Eqs. (A.3) and (A.4) yields:

$$A_{Human\_avail} = (1- A_{Forest}) – c' (1- A_{Forest})^{z'} \quad (A.5)$$

Open-habitat species should respond to available open habitat (A_{Human_avail}) as according to a power relationship:

$$S_{open} = c (A_{Human\_avail})^{z} + d \log_{10} E \quad (A.6)$$

where *c* and *z* are derived constants and *E* is the log of sampling effort measured in hours. Combining eq.(A.5) and (A.6), we have the "lost habitat model":

$$S_{open} = c((1- A_{Forest}) – c' (1- A_{Forest})^{z'})^{z} + d \log_{10} E \quad (A.7)$$

Therefore, we fitted Eq. (A.7), the Lost-Habitat model, to open-habitat species richness as function of the amount of human-dominated landscape in each 100 km^2. The constants *c'* and *z* were empirically derived from the data. The disadvantage of this function is that non-linear functions with many free parameters can be impossible to fit. For example, we wanted to test whether the species pool (i.e., bird species obtained from course range maps) may contribute to explain the variance in species richness in each BBA quadrats once richness varies as a function of abiotic factors (e.g., Temperature). However, when we included the number of species in the species pool as a covariate in the "lost habitat model" (Eq. A.7), the models failed to converge.