Appendix C: Countryside model

The Countryside model (Pereira and Daily 2006) is a species-area model proposed to account for variation in species richness among human-dominated landscapes. In essence, the model proposes that landscapes are composed of multiple habitats, and that species assemblages in those landscapes are composed of multiple guilds. Guilds show differing degrees of affinity for different habitat types. Species richness of a given guild *i* varies as a power function of the sum of affinity *h* of the guild for each habitat type *j*, times the area of that habitat *Aj*:

$$S_i = c_i\left(\sum_j h_{ij}A_j\right)^z \qquad \text{(C.1)}$$

where c_i and z are empirical constants. Total richness S_{Total} is the sum of the richness of all guilds:

$$S_{Tot} = \sum_i S_i \qquad \text{(C.2)}$$

The model has been validated in agricultural landscapes with birds (Guilherme and Miguel Pereira 2013) and plants (Proença and Pereira 2013).

In our study, we proposed that total richness is composed of two general guilds – forest birds and open-habitat birds – which respond to two habitat types: forest, and human-dominated land cover.

We fitted the countryside model (Eq. C.1) to the richness of these two guilds, allowing *z* and two *h* constants (i.e., the affinities for each habitat) to be free parameters. We also included a term to account for variation in the logarithm of sampling effort among quadrats. The resulting fitted model yielded parameter estimates that reduce to Classic-SARs (Table C1): for each guild, the affinity for the

non-preferred habitat type is essentially 0. Therefore richness in each guild is a Classic-SAR, a power function of the area of the preferred habitat (i.e., the SAR curves shown in Figs. 2 and 3 in the main text). The countryside model in this case becomes identical to the model of Desrochers et al. (2011). The countryside model (and the Desrochers model) predicts a peaked relationship between total species richness and forest cover. However, these two models fail to predict the peaked relationship between richness of open-habitat birds and forested (or human-dominated) land cover.

The difference between our approach and the countryside model is the exclusion of unavailable habitat – "lost" area - from human-dominated areas. We assume that such lost area increases as a power function of the proportion of human-dominated areas in each 100 km^2.

TABLE C1. Nonlinear regression results from the fitted countryside model for total, forest and open-habitat species richness in 100km^2 quadrats localized in southern Ontario. $h_{o,F}$ is the habitat affinity of open-habitat birds to forest cover; $h_{o,HD}$ is the habitat affinity of open-habitat birds to human-dominated landscapes; $h_{f,F}$ is the habitat affinity of forest birds to forest area; $h_{f,HD}$ is the habitat affinity of forest birds to human-dominated area; *c* and *z* and *d* are empirical constants. Total richness model constants, *c* and *z*, were obtained by fitting the model using the habitat affinities from forest and open-habitat models. *d* is the coefficient of an additive term accounting for the logarithm of the number of hours spent censusing each quadrat. *RSS* is the residual sum of the squares from the nonlinear regression; *AICc* is the corrected Akaike information criterion; and R^2_{adj} is the adjusted R^2.

	c	$h_{o,F}$	$h_{o,HD}$	$h_{f,F}$	$h_{f,HD}$	z	d	RSS	AICc	R^2_{adj}
Forest birds	27.77			1.67	0.001	0.37	11.12	38,878	6452	0.60
Open-habitat birds	33.15	0.000	0.867			0.17	14.57	78,132	7146	0.53
Total Richness	38.90	0.000	0.867	1.67	0.001	0.340	30.46	200,276	8081	0.28

LITERATURE CITED

Guilherme, J. L., and H. Miguel Pereira. 2013. Adaptation of bird communities to farmland abandonment in a mountain landscape. PloS one 8:e73619.

Pereira, H. M., and G. C. Daily. 2006. Modeling biodiversity dynamics in countryside landscapes. Ecology 87:1877–85.

Proença, V., and H. Pereira. 2013. Species – area models to assess biodiversity change in multi-habitat landscapes: The importance of species habitat affinity. Basic and Applied Ecology 14:102–114.