Appendix 1. Governing equations and parameters used to calculate production possibility frontiers (PPFs) in Figure 3, which provides a stylized representation of the tradeoffs between agricultural production and species richness at the national scale, and at local scales within 3 different ecological regions, in Mexico.

General species-area and agricultural production-area functions

The trade-off between the biodiversity or species richness (S) that can be sustained from land area in natural habitat (A_H) on the one hand, and the agricultural production (P) that can be derived from land area dedicated to crops (A_C) can be expressed mathematically as follows: The total land area (A_T) under consideration can be partitioned between habitat (A_H) and crop (A_C) production such that

$$A_T = A_H + A_C. \tag{A1.1}$$

Both species richness and agricultural production are a function of area such that

$$S = \alpha A_H^z \tag{A1.2}$$
$$P = \beta A_C, \tag{A1.3}$$

where z is the slope of the log-log relationship between S and A_H, α is a constant (y-intercept) and β is the crop yield per unit area. The relationship between species richness (S) and agricultural production (P) can thus be written as:

$$S = \alpha(1-P/\beta)^z \tag{A1.4}$$

Calculations of stylized PPFs for Figure 3

Figure 3 provides an example of an aggregated land area, in this case the country of Mexico, that is subdivided into three regions (i=1,2,3), each of which has different biophysical capacities to support agriculture and biodiversity. The full spatial extent of the aggregated region, A_T, is set to unity; m_i is the fraction of total land area apportioned to the regional subdivision i, and these values also sum to unity.

$$m_1 + m_2 + m_3 = A_T = 1 \tag{A1.5}$$

The regional-level coefficient α_i is the y-intercept log-log species-area relationship for region i, and influences the total number of species that can accumulate in a given area of land in that region; z_i is the slope of the log-log species-area relationship for region i.

Crop area, A_{Ci}, for each region i is the total land area less the area conserved as habitat for biodiversity A_{Hi},

$$A_{Ci} = m_i - A_{Hi} \tag{A1.6}$$

and total crop area for the aggregated regions, rearranged from (A1.1) is $A_{CT} = A_T - A_{HT}$.

Each region has a different capacity to produce food, determined by the coefficient, β_i. Total crop productivity at the aggregate national scale, P_T, can be written as

$$P_T = \beta_1 A_{C1} + \beta_2 A_{C2} + \beta_3 A_{C3} \tag{A1.7}$$

$$P_T = \Sigma\left[\beta_i A_{ci}\right]$$

Each region has a different capacity for maintaining species diversity, determined by parameters α_i and z_i. The total number of species (S_T) that can accumulate in the nation if all land is conserved as habitat for biodiversity is the sum of each parcel:

$$S_T = \alpha_1 (m_1 A_H)^{z_1} + \alpha_2 (m_2 A_H)^{z_2} + \alpha_3 (m_3 A_H)^{z_3} \tag{A1.8}$$

$$S_T = \Sigma\left[\alpha_i (m_i A_H)^{z_i}\right]$$

Table A1.1: Parameters used to simulate three distinct ecological regions (i=1,2,3) and generate PPFs in Figure 3.

Region (i)	Region label in Figure 3	α_i	z_i	β_i	m_i
1	A	20	0.3	10	0.25
2	B	10	0.26	15	0.35
3	C	5	0.27	20	0.4

R-code to run the example shown in the paper can be found at https://github.com/cavender/Trade-offs.