1 - Construction of the matrices

Each matrix represents the Jacobian matrix of an unspecified dynamical system evaluated at a feasible (i.e., where all species have positive densities) equilibrium point for the system. The feasibility of the equilibrium is postulated, as in other similar studies[1–4], as unfeasible systems are clearly not ecologically interesting. Here we detail how these matrices were constructed. In all cases, the parameters are: S, number of species, C, desired level of connectance, $-d$, value of the diagonal coefficients $(d > 0)$, σ, the standard deviation of the random variable X from which the coefficients M_{ij} take value. In the construction algorithms, we use the normal distribution case ($X \sim N(0, \sigma^2)$) as an example. The algorithms can accommodate different distributions, such as those examined in the main text and in the section 4 of the SI.

1.1 - Random Matrices

In the random case, we construct the matrices in the following way: i) For each off-diagonal coefficient $M_{ij,i\neq j}$, we draw a random value p from a uniform distribution $U[0, 1]$. ii) If the value is $p \leq C$, we set coefficient M_{ij} by sampling it from $N(0, \sigma^2)$. iii) Otherwise ($p > C$), $M_{ij} = 0$. iv) All diagonal terms, M_{ii}, are set to $-d$.

These matrices, for large S, generate a precise mixture of interaction types, with predator-prey interactions being represented twice as frequently as mutualistic or competitive ones (Table S1).

1.2 - Predator-Prey Matrices

In the predator-prey case, i) For each pair of interactions $(M_{ij}, M_{ji})_{i>j}$, we draw a random value p_1 from a uniform distribution $U[0,1]$. ii) If $p_1 \leq C$, we draw a second random value p_2 from $U[0,1]$. iii) If $p_2 \leq 0.5$, we draw M_{ij} from a half-normal distribution $|N(0,\sigma^2)|$ and M_{ji} from a negative half-normal $-|N(0,\sigma^2)|$, while if $p_2 > 0.5$ we do the opposite. iv) If $p_1 > C$, we assign 0 to both M_{ij} and M_{ji}. v) All diagonal terms, M_{ii}, are set to $-d$.

1.3 - Mixture of Competition and Mutualism Matrices

i) For each pair of interactions $(M_{ij}, M_{ji})_{i>j}$, we draw a random value p_1 from a uniform distribution $U[0,1]$. ii) If $p_1 \leq C$, we draw a second random value p_2 from $U[0,1]$. iii) If $p_2 \leq 0.5$, we draw M_{ij} and M_{ji} independently from a half-normal distribution $|N(0,\sigma^2)|$, while if $p_2 > 0.5$ we draw them from a negative half normal distribution $-|N(0,\sigma^2)|$. iv) If $p_1 > C$, we assign 0 to both M_{ij} and M_{ji}. v) All diagonal terms, M_{ii}, are set to $-d$.

1.4 - Mutualistic Matrices

i) For each pair of interactions $(M_{ij}, M_{ji})_{i>j}$, we draw a random value p from a uniform distribution $U[0,1]$. ii) If $p \leq C$, we draw M_{ij} and M_{ji} independently from a half-normal distribution $|N(0,\sigma^2)|$. iii) If $p > C$, we assign 0 to both M_{ij} and M_{ji}. iv) All diagonal terms, M_{ii}, are set to $-d$.