

# Supplementary Materials

## Methodology

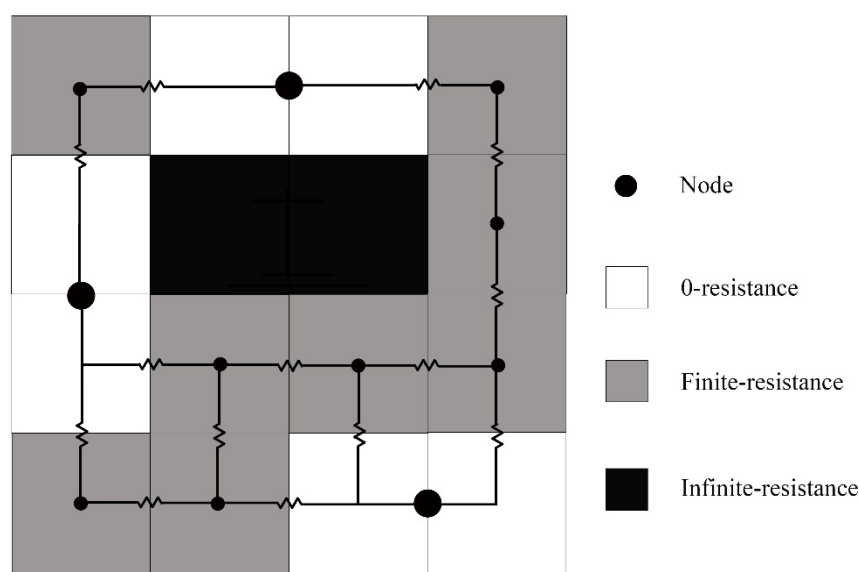
### Section S1: Environment Variable Definition and Filtering

Table S1. Environment variable.

Data types	Indicator	Specific Interpretation	Unit	Note
Bioclimatic variables	BIO1	Annual Mean Temperature	°C	
	BIO2	Mean Diurnal Range (Mean of monthly	°C	★
	BIO3	Isothermality	1	★
	BIO4	Temperature Seasonality	1	★
	BIO5	Max Temperature of Warmest Month	°C	
	BIO6	Min Temperature of Coldest Month	°C	
	BIO7	Temperature Annual Range	°C	★
	BIO8	Mean Temperature of Wettest Quarter	°C	
	BIO9	Mean Temperature of Driest Quarter	°C	
	BIO10	Mean Temperature of Warmest Quarter	°C	
	BIO11	Mean Temperature of Coldest Quarter	°C	
	BIO12	Annual Precipitation	mm	
	BIO13	Precipitation of Wettest Month	mm	
	BIO14	Precipitation of Driest Month	mm	★
	BIO15	Precipitation Seasonality	1	★
	BIO16	Precipitation of Wettest Quarter	mm	
	BIO17	Precipitation of Driest Quarter	mm	★
	BIO18	Precipitation of Warmest Quarter	mm	
	BIO19	Precipitation of Coldest Quarter	mm	★

★ stands for this variable is selected

### Section S2: Circuit Theory Schematic



**Figure S1.** Circuit theory diagram. The landscape contains 0-resistance cells (white), dispersal habitat of finite resistance (gray), and “barrier” cell with infinite resistance (black). Cells with finite resistance are replaced with nodes (small dots), and adjacent nodes are connected by resistors. Patches of cells with 0 resistance are each consolidated into a single node (large dots).

## Results

### Section S3: Spatial Pattern of Ecological Networks

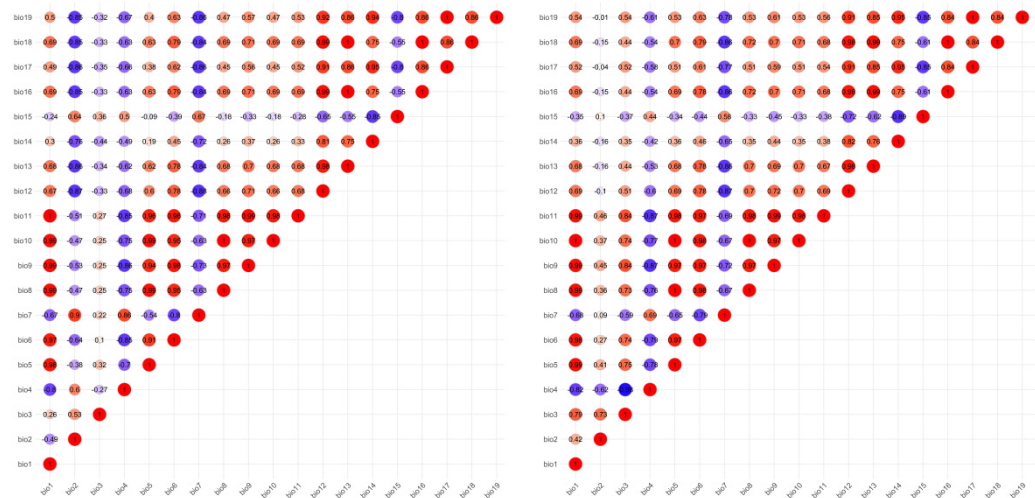


Figure S2. Environmental variable correlation.

### Section S4: Calculation of SPCA

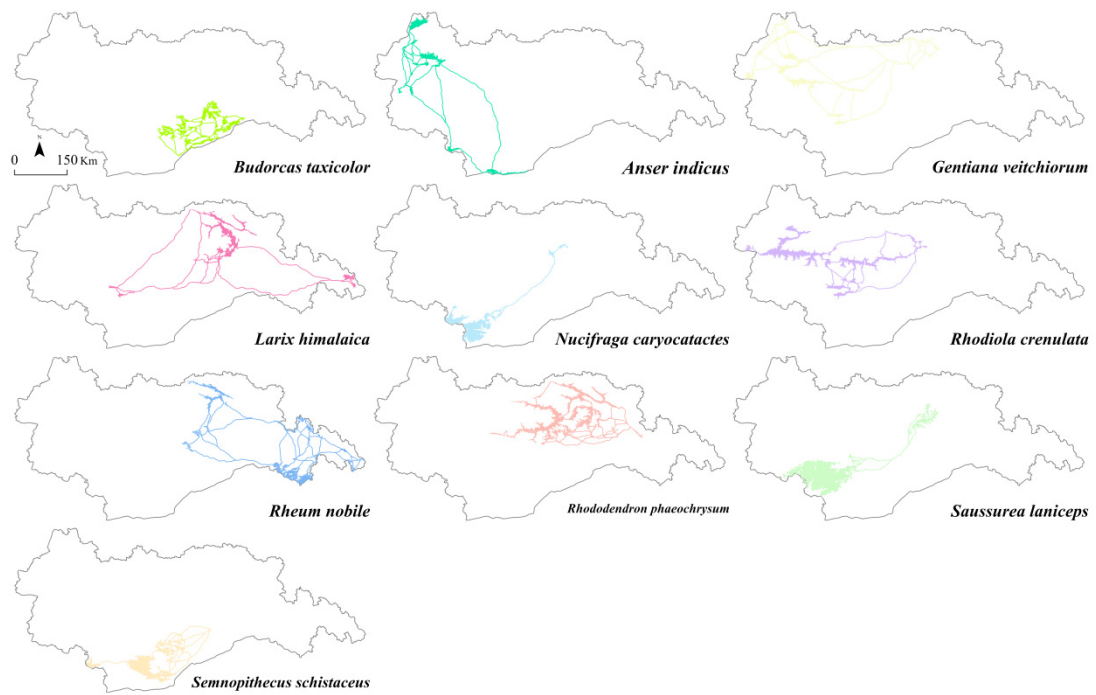
Table S2. Characteristic values of principal components and their contribution rates.

Principal Components	Eigenvalue	Contribution Rate /%	Cumulative Contribution Rate /%
1	7.10169	42.9601	42.9601
2	4.16617	25.2023	68.1624
3	2.4714	14.9502	83.1126
4	1.58424	9.5835	92.696
5	1.11348	6.7358	99.4318
6	0.09393	0.5682	100

Table S3. Principal component load matrix.

Resistance Factor	Principal Components					
	1	2	3	4	5	6
Road distance	0.00512	-0.02354	-0.00583	-0.01725	0.0427	0.99863
Water source distance	0.3558	0.45077	-0.41996	0.5663	0.4161	-0.00166
Elevation	0.56847	0.18224	0.12632	-0.69175	0.38532	-0.02631
LULC	0.60069	0.14768	0.04073	0.10602	-0.77665	0.03568
NDVI	0.02348	0.24721	0.89471	0.33564	0.15837	0.00995
Nighttime lighting	0.43456	-0.82469	0.07402	0.27676	0.21976	-0.02586

## Section S5: Spatial Pattern of Ecological Networks



**Figure S3.** Ecological networks for each species.