forests MDPI

Supplementary Material S1: Selection of indicator species in Qingling mountain study

Expert decision method was used to select indicator species at Qingling mountain scale following four criterions:

1) Endangered species attract public attention and should thus be prioritized.
2) Species with direct economic value should also be given higher priority of protection.
3) Species with important cultural representativeness should be protected.
4) Umbrella species should be given priority for protection.

Accordingly, 23 species was included (Table S1).

Table S1. Name list of indicator species in Qinling mountain region.

Latin Name	Chinese Protection level	IUCN Endangerment categories	Class
Ailuropoda melanoleuca	I	EN	Mammalia
Rhinopithecus raxllana	I	EN	Mammalia
Budorcas taxicolor	I	EN	Mammalia
Moschus berezovskii	I	EN	Mammalia
Neofelis nebulosa	I	VU	Mammalia
Profelis temminchi	II	NE	Mammalia
Viverra zibetha	II	EN	Mammalia
Nemorhaedus goral	II	EN	Mammalia
Capricornis sumatraensis	II	VU	Mammalia
Nipponia nippon	I	EN	Aves
Chrysolophus pictus	II	LC	Aves
Ithaginis cruentus	II	LC	Aves
Aquila chrysaetos	I	LC	Aves
Paradoxornis paradoxus	Local endangered	LC	Aves
Garrulax lunulatus	Local endangered	LC	Aves
Abies chensiensis Tiegh	II	VU	Floral
Taxus chinensis (Pilger) Rehd	I	EN	Floral
Taxus mairei SY Hu	I	EN	Floral
Picea neoveitchii	II	EN	Floral
Elaeagnus mollis Diels	II	VU	Floral

Syringa pinnatifolia	III	LC	Floral
Psathyrostachys huashanica	I	NE	Floral
Sinowilsonia henryi Hemsl	II	NE	Floral

Supplementary Material S2: Biodiversity mapping in mainland China study

Species richness map was generated by a simplified ecological niche model as follow (Xu et al, 2009; Zhang et al, 2015):

$$pH_i = C_i IE$$

Where pH_i indicates whether polygon i is a potential habitat or not; E is the suitable ecosystem for the species; I is the overlap of suitable elevation, slope and aspect for the species; C_i is the record of historical distributions of indicator species in County i. For each indicator species, a Boolean habitat image was generated that comprised: 1 is "available habitat patch" including factual habitat and modeled potential habitat, 0 is "unavailable habitat patch".

Habitat distribution of each indicator species was model by an automatic batch program using Python 2.7.

Supplementary Material S3: Examples of ROC curve verification of mammal indicator species in Qinling Mountain

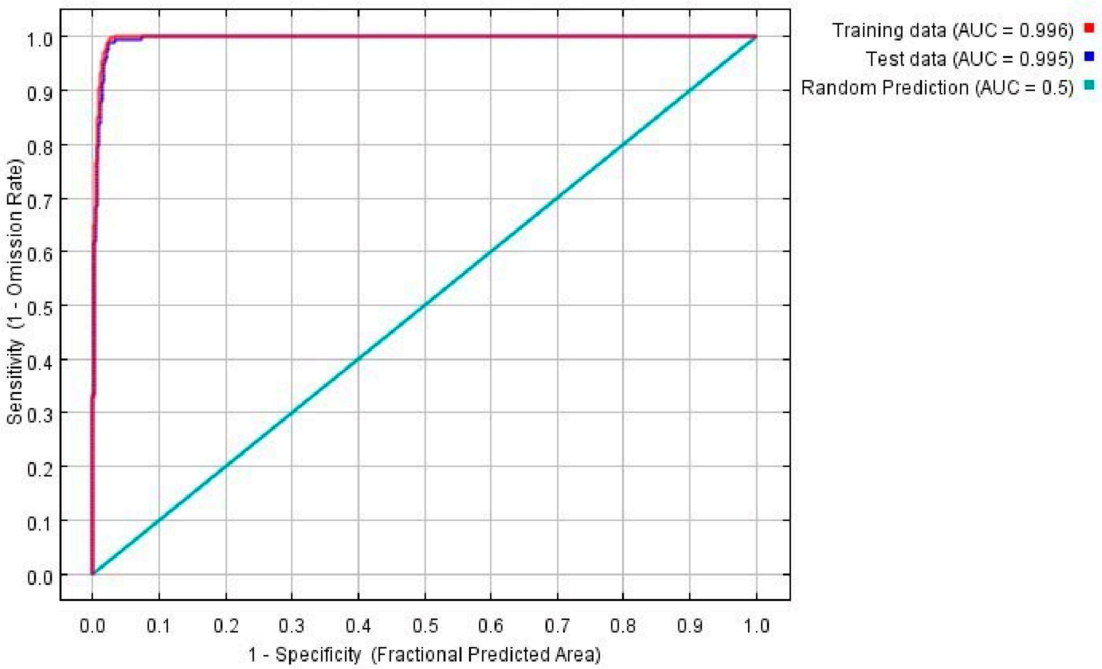

Figure S1. ROC curve verification of giant panda.

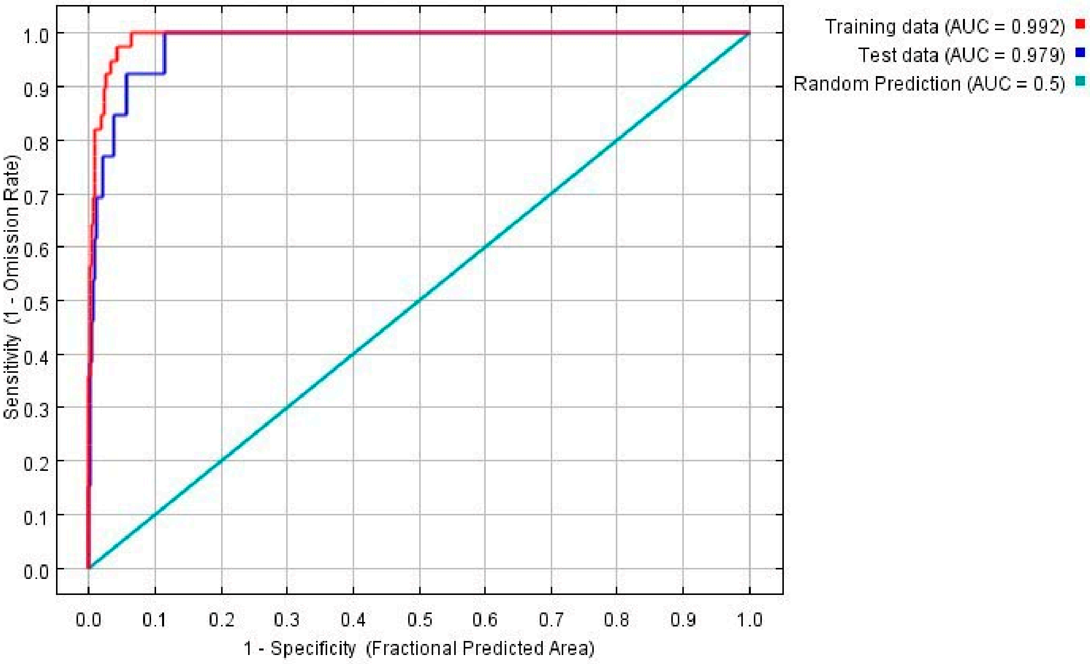

Figure S2. ROC curve verification of Sichuan golden monkey.

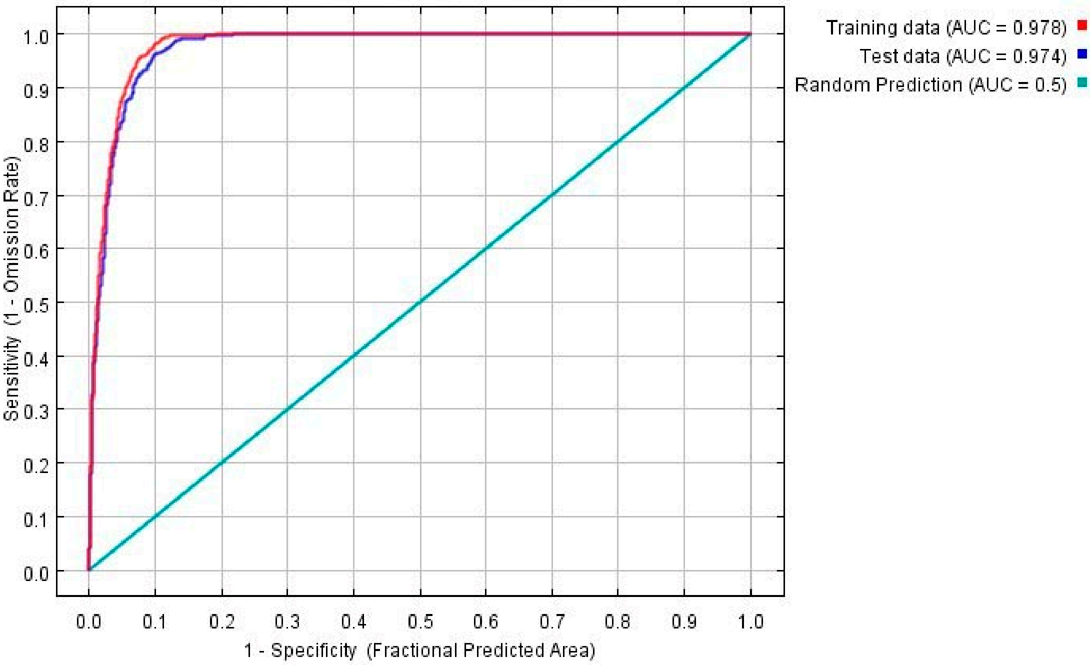

Figure S3. ROC curve verification of takin.

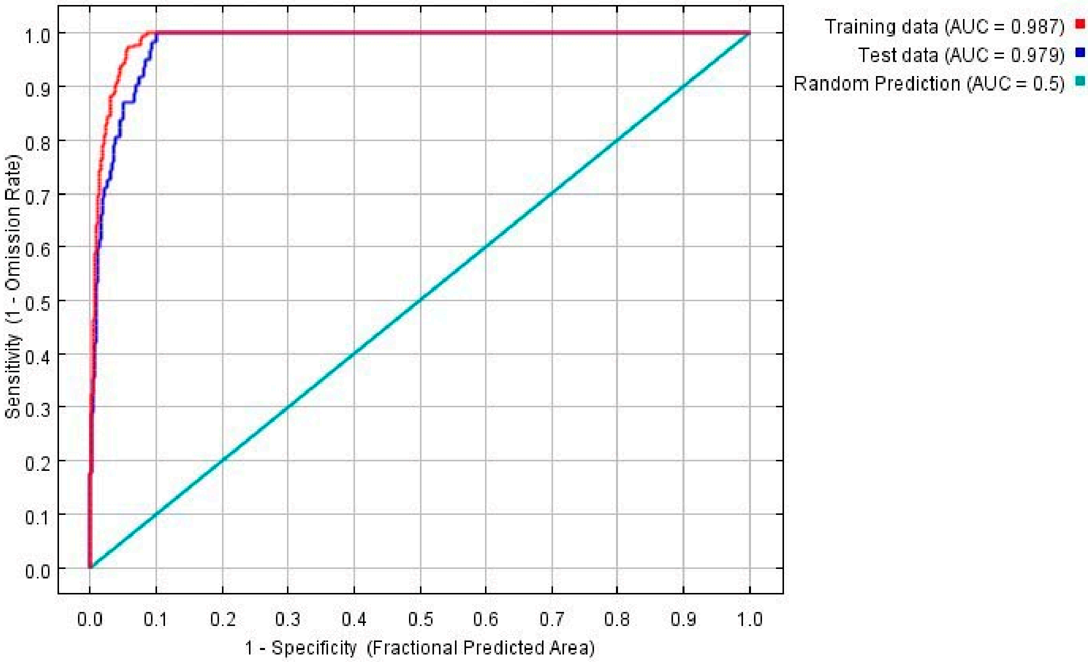

Figure S4. ROC curve verification of Chinese goral.

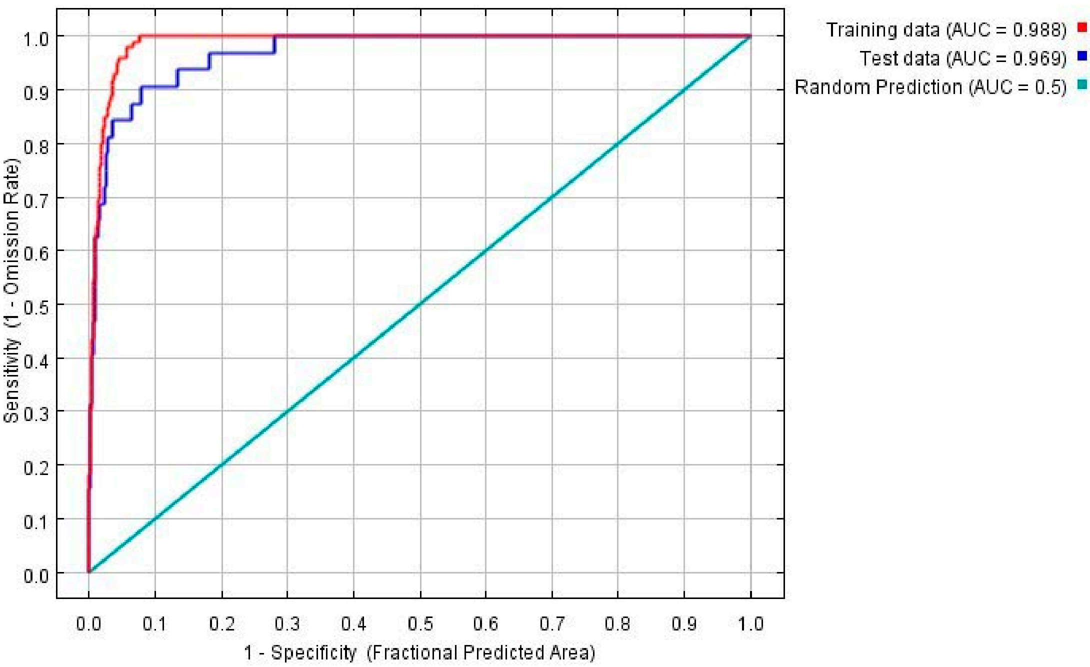

Figure S5. ROC curve verification of Serow.

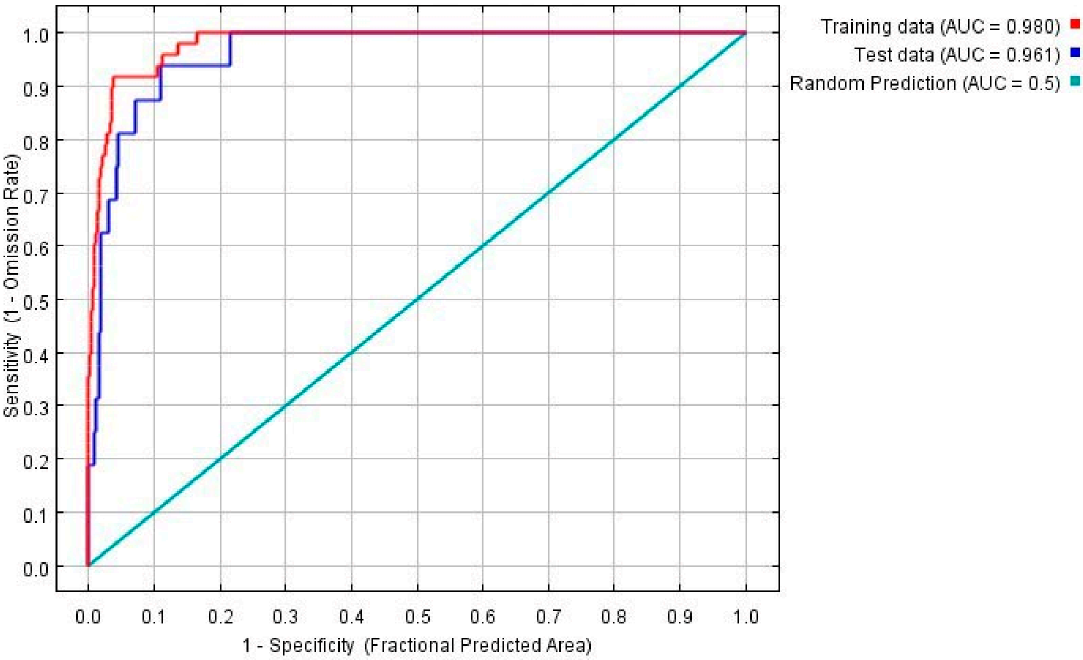

Figure S6. ROC curve verification of Chinese forest musk deer.

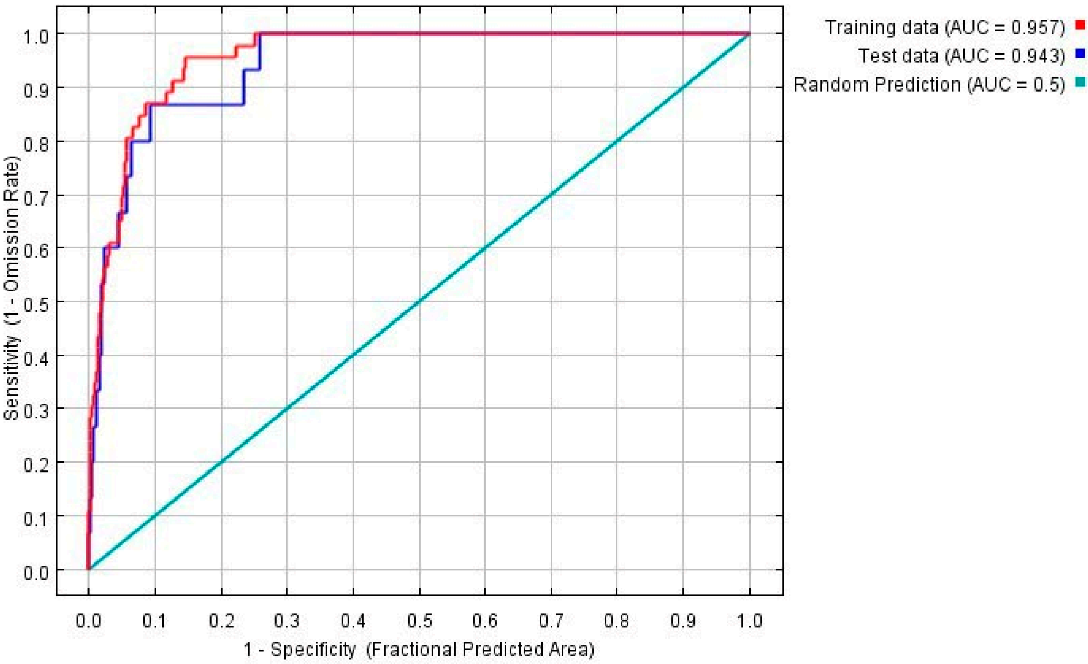

Figure S7. ROC curve verification of Asiatic golden cat.

Supplementary Material S4: Modeling of soil retention

We estimate soil retention by using the universal soil loss equation as follow (Rao, et al., 2014):

Soil retention ($t/hm^2 \cdot a$)：

$$A_{soil\ retention} = A_{potential\ erosion} - A_{actural\ erosion}$$

Actural soil erosion (t/hm^2·a)：

$$A_{actural\ erosion} = R \times K \times L \times S \times C$$

Potential soil erosion (t/hm^2·a)：

$$A_{potential\ erosion} = R \times K \times L \times S$$

Where R is the rainfall erosivity factor; K is the soil erodibility factor; LS is the topographic factor; and C is the vegetation cover factor.

R can be calculated by Fouriner index（MJ mm hm^{-2} h^{-1} a^{-1}）:

$$R = 4.17 \cdot \sum_{i=1}^{12} \frac{j_i^2}{J} - 152$$

Where *j* is monthly precipitation(mm)；*J* is annual precipitation(mm)；*i* is 12 month per year。

K can be calculated by following equation (t ha h ha^{-1} MJ^{-1} mm^{-1}):

$$\begin{aligned} K = &\left\{0.2 + 0.3\exp\left[-0.0256 m_s(1 - m_{silt}/100)\right]\right\} \times [m_{silt}/(m_c + m_{silt})]^{0.3} \\ &\times \left\{1 - 0.25 orgC/[orgC + \exp(3.72 - 2.95 orgC)]\right\} \\ &\times \left\{1 - 0.7(1 - m_s/100)/\{(1 - m_s/100) + \exp[-5.51 + 22.9(1 - m_s/100)]\}\right\} \end{aligned}$$

m_c、m_{silt}、m_s和 *orgC* are the mass percentages of sand (0.02–2 mm), silt (0.002–0.02 mm), clay (<0.002 mm), and ratio of organic carbon(%), respectively.

*L(slope length factor)*and *S(slope factor)* described topology factor which can be calculated as follows:

$$L = \left(\frac{\lambda}{22.13}\right)^m$$

$$m = \beta/(1+\beta)$$

$$\beta = (\sin\theta/0.089)/\left[3.0 \times (\sin\theta)^{0.8} + 0.56\right]$$

$$S = \begin{cases} 10.8\sin\theta + 0.03 & \theta < 5.14° \\ 16.8\sin\theta - 0.5 & 5.14° \le \theta < 10.20° \\ 21.91\sin\theta - 0.96 & 10.20° \le \theta < 28.81° \\ 9.5988 & \theta > 28.81° \end{cases}$$

Where m is the slope length index; θ is slope gradient (°); and λ is slope length(m).

C factor was calculated according to following table(Table S2)

Table S2. C factor values for different vegetation ecosystems.

Ecosystem types	Vegetation coverage (%)					
	<10	10–30	30–50	50–70	70–90	>90
Forests	0.1	0.08	0.06	0.02	0.004	0.001
Shrubs	0.4	0.22	0.14	0.085	0.04	0.011
Grasslands	0.45	0.24	0.15	0.09	0.043	0.011

Appendix S4 Modeling of water retention

We estimate water retention by using the simplified water balance equation, which was revised from InVEST model (Kareiva, *et al.*, 2011; Ouyang, et al., 2016)

$$TQ = \sum_{i=1}^{j}(P_i - R_i - ET_i) \cdot A_i$$

Where *TQ* is total water supply, P_i is precipitation, R_i is storm runoff, ET_i is evapotranspiration, and A_i is the area of the ecosystem as defined by land cover. Precipitation was generated by spatial interpolation method. Evapotranspiration data was obtained from the Chinese Academy of Sciences. Runoff coefficient values were estimated from over 300 publications on surface runoff across a range of land ecosystems.

$$R = P \times \alpha$$

Where R is the runoff, P is the precipitation, α is the runoff coefficient (Table S3).

Table S3. The mean runoff coefficient value of natural ecosystems.

Ecosystem types		Mean coefficient value（%）
Forest type	Evergreen broad-leaf forest	4.65
	Evergreen coniferous forest	4.52
	Mixed broadleaf-conifer forest	3.52
	Deciduous broadleaf forest	2.7
	Deciduous coniferous forest	0.88
	Sparse forests	19.2
Grassland type	Alpine meadow	8.2
	Alpine grassland	6.54
	Temperate grassland	3.94
	Temperate grassland	9.37
	Temperate meadow steppe	9.13
	Tropical and subtropical grassland	3.87
Other types	Evergreen broadleaf shrubs	4.26
	Deciduous broad-leaved shrub	4.17

Conifer shrub	4.17
Sparse scrub	19.2
Garden	9.57
Marshes and reservoirs	0

Supplementary Material S5: Mapping of ecological indicators

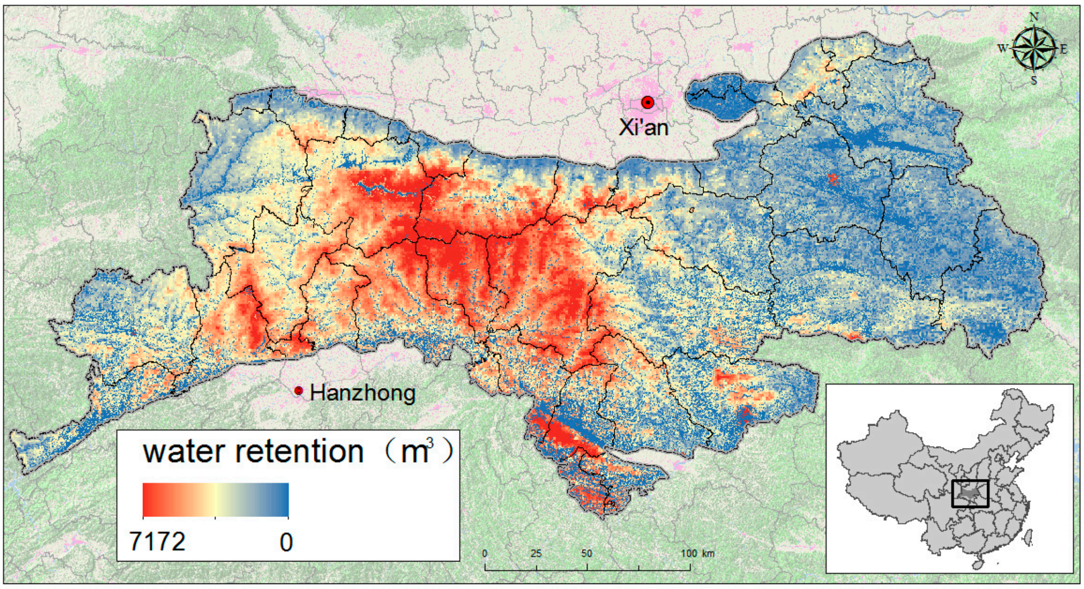

Figure S8. Mapping of soil retention in Qinling mountain region.

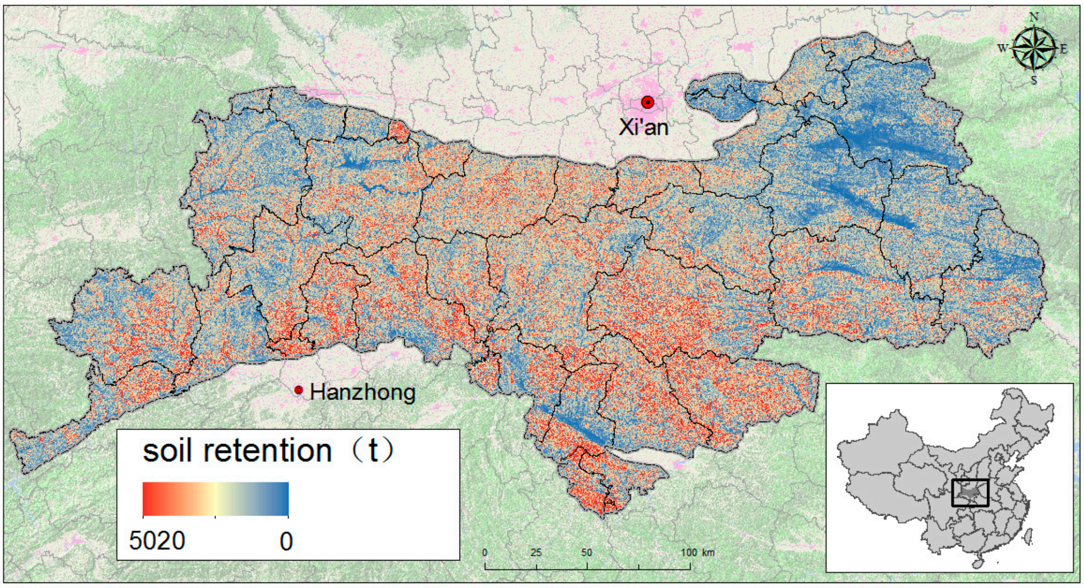

Figure S9. Mapping of water retention in Qinling mountain region.

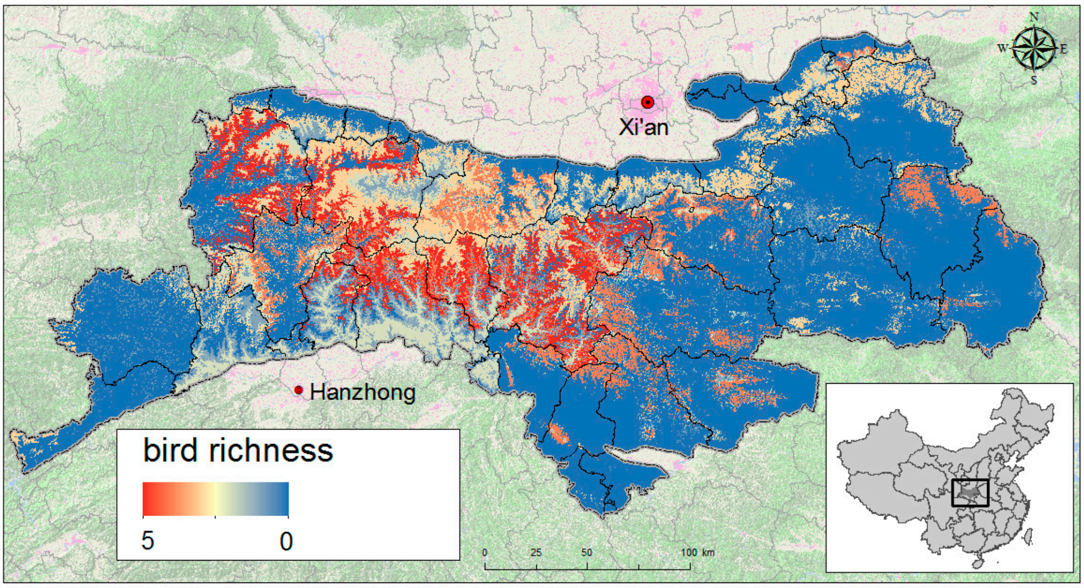

Figure S10. Mapping of bird richness in Qinling mountain region.

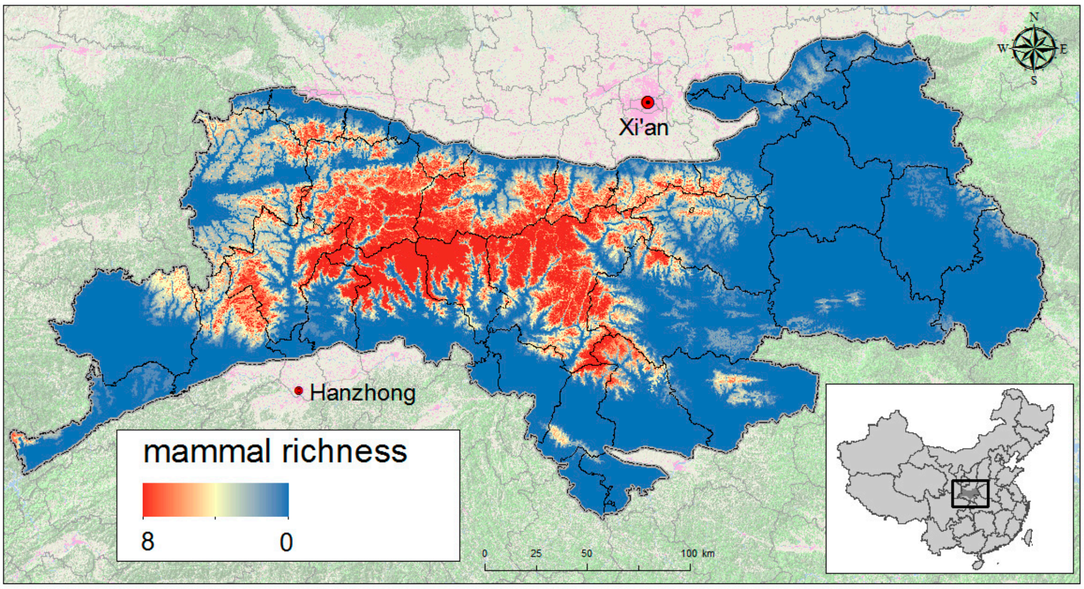

Figure S11. Mapping of mammal richness in Qinling mountain region.

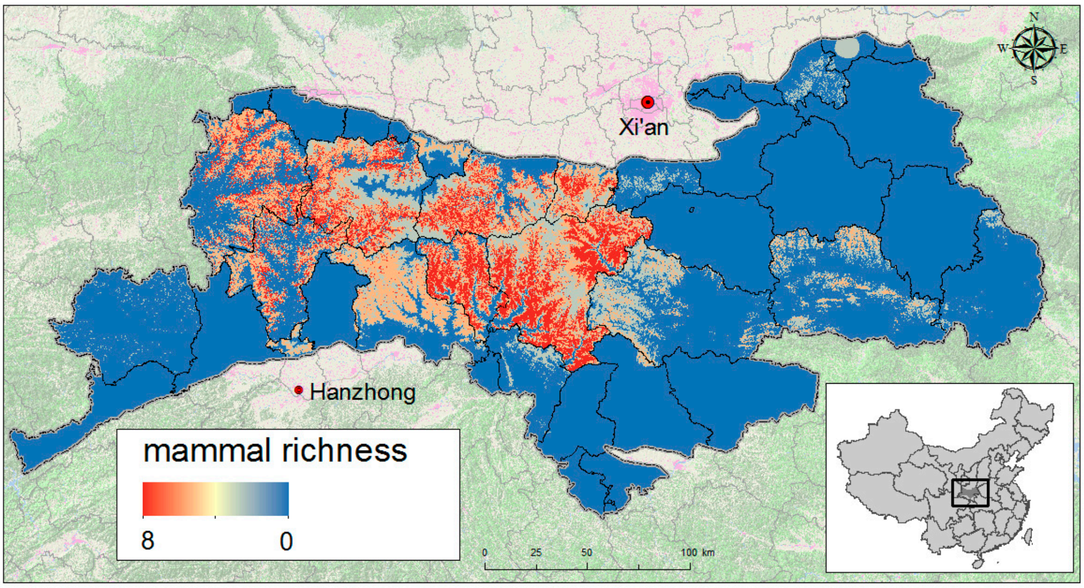

Figure S12. Mapping of plant richness in Qinling mountain region.

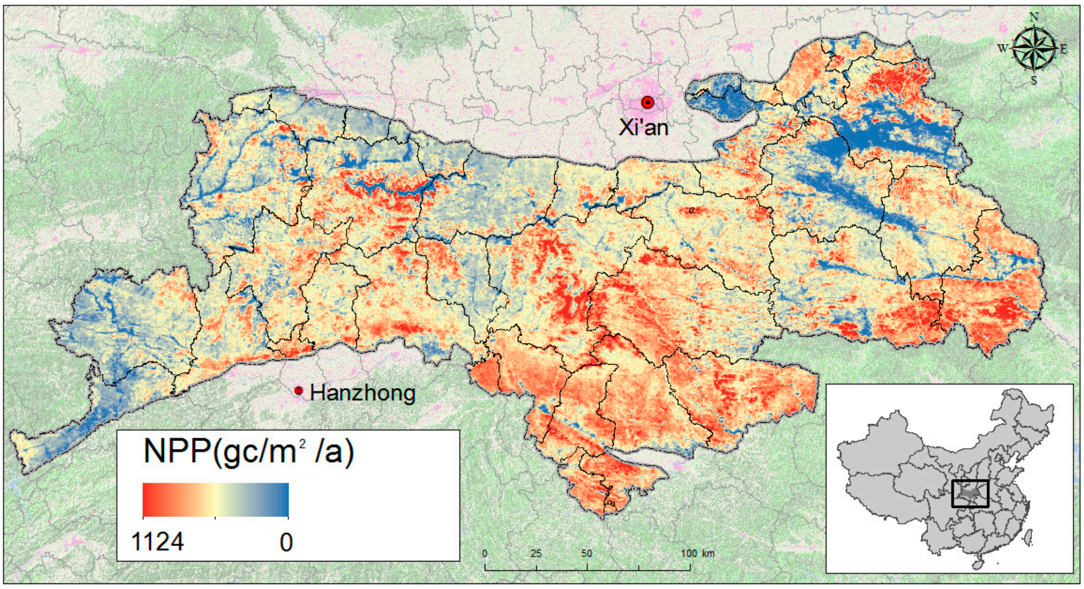

Figure S13. Mapping of NPP in Qinling mountain region.

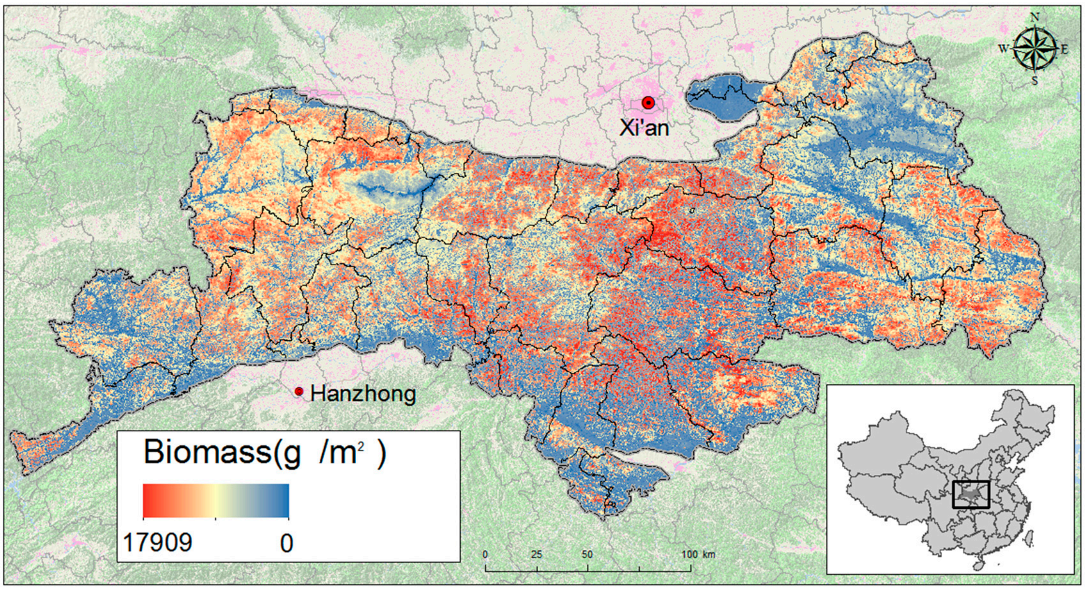

Figure S14. Mapping of biomass in Qinling mountain region.

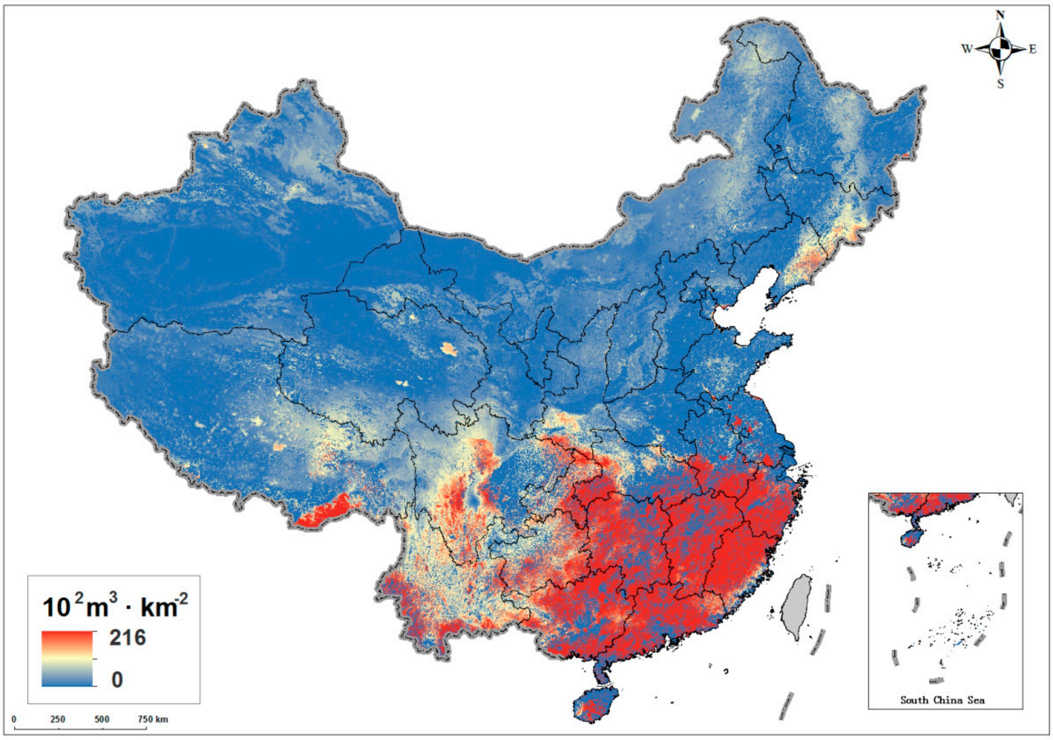

Figure S15. Mapping of water retention in mainland China.

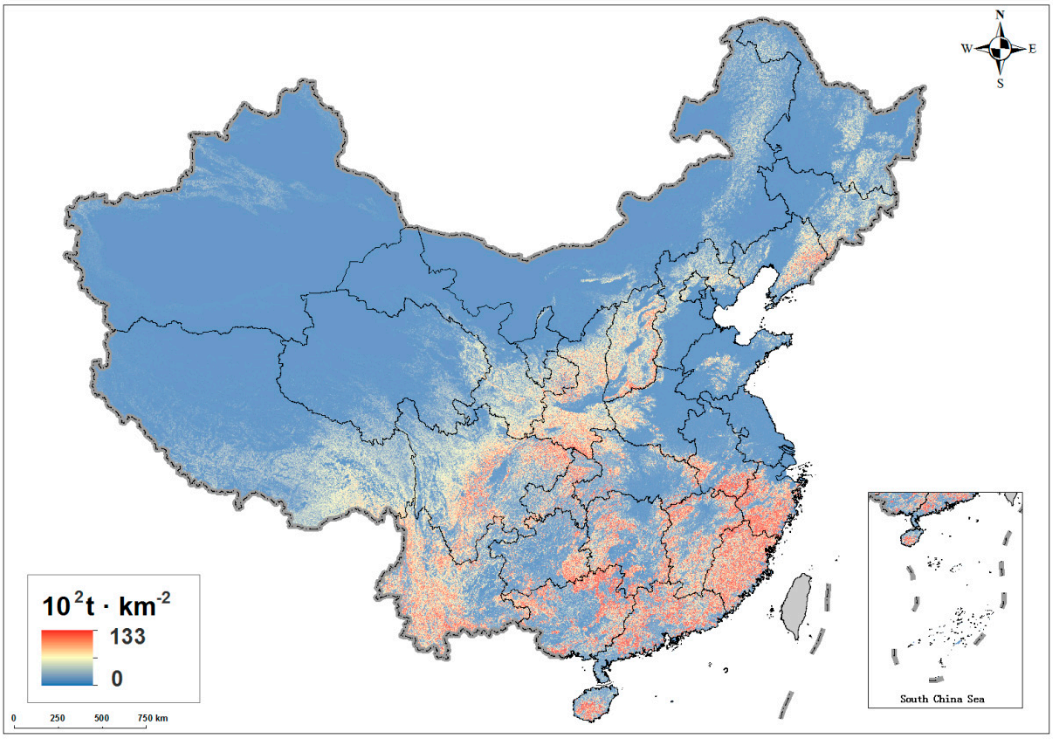

Figure S16. Mapping of soil retention in mainland China.

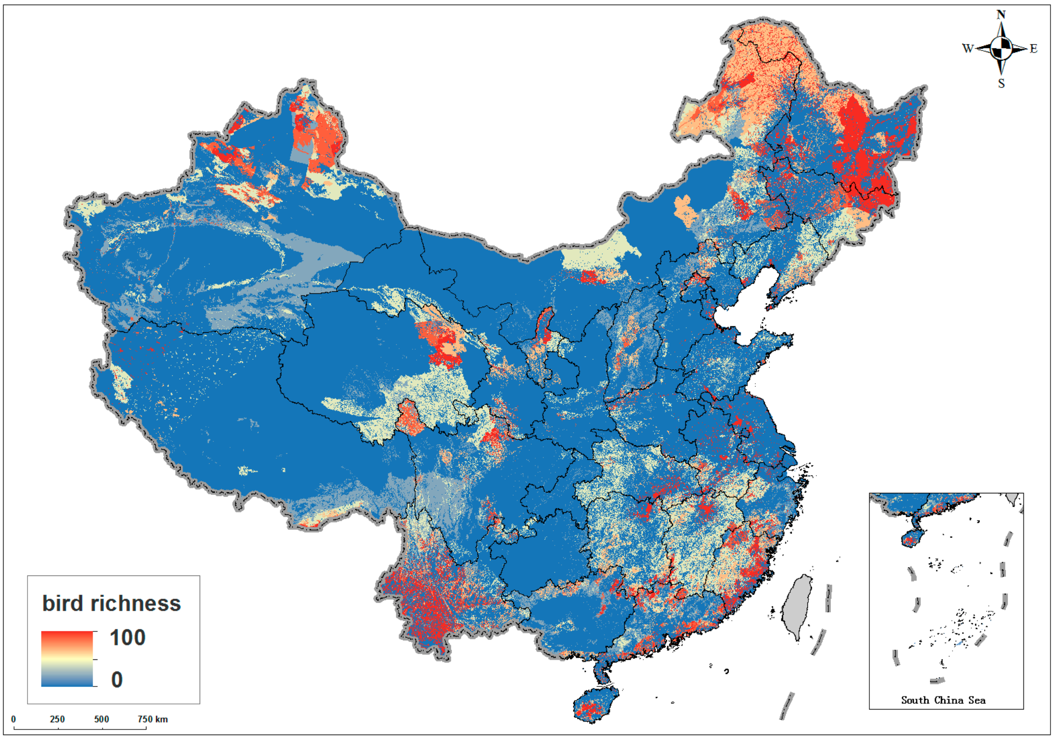

Figure S17. Mapping of bird richness in mainland China.

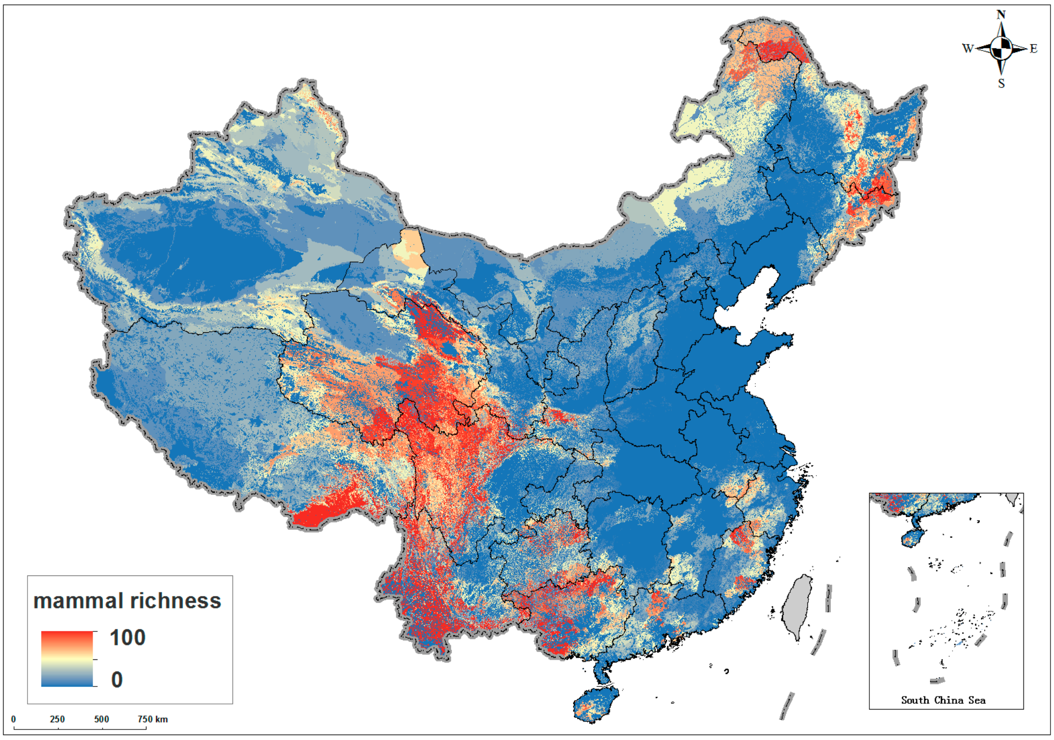

Figure S18. Mapping of mammal richness in mainland China.

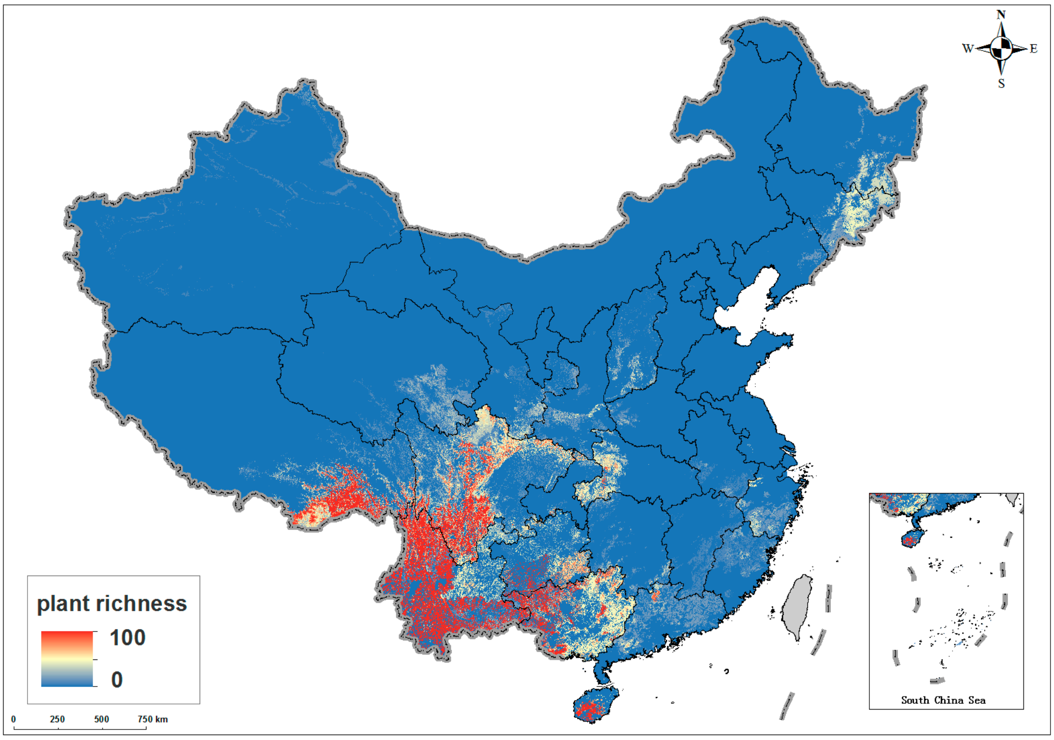

Figure S19. Mapping of plant richness in mainland China.

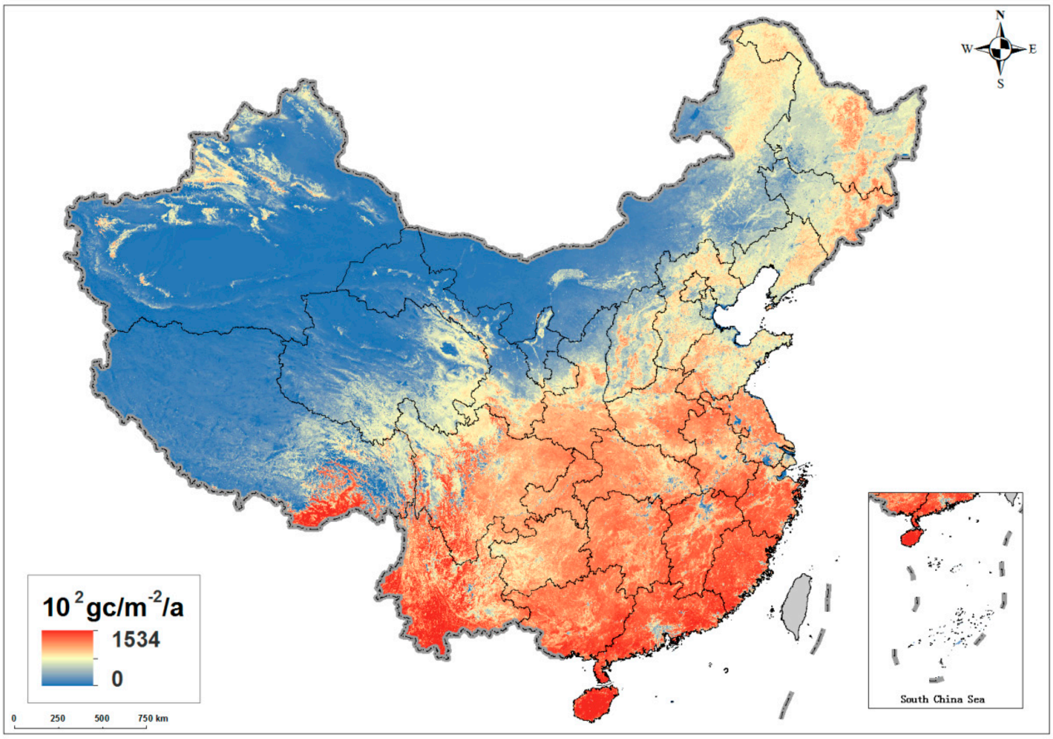

Figure S20. Mapping of NPP in mainland China.

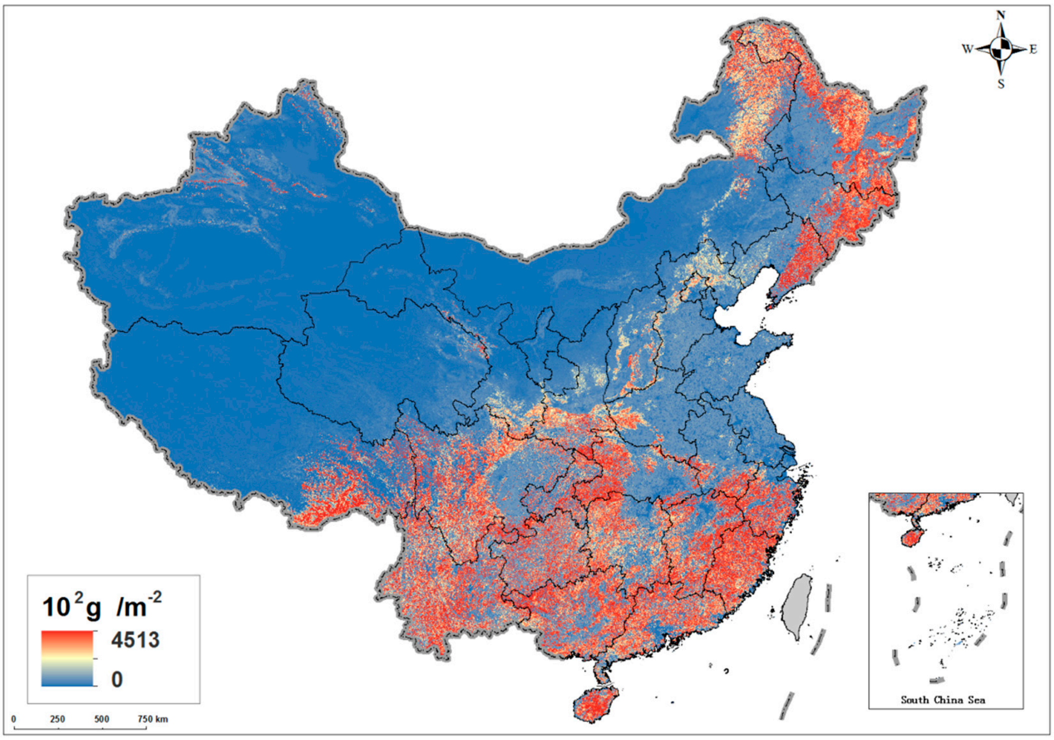

Figure S21. Mapping of biomass in mainland China.

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5. Zhang L, Dong T, Xu W, Ouyang Z (2015) Assessment of habitat fragmentation caused by traffic networks and identification of key impacted areas for rare wildlife conservation in China. Wildlife Research 42: 266–279.