

Ecography

**E7786**

Wang, Z., Rahbek, C. and Fang, J. 2012. Effects of geographical extent on the determinants of woody plant diversity. – *Ecography* 35: xxx–xxx.

**Supplementary material**

**Appendix 1** List and statistics of the variables used in the analysis. In the table, SD means standard deviation, MMT is the mean month temperature ( $^{\circ}\text{C}$ ), and MMP is the mean monthly precipitation (mm).

<i>Variables</i>	<i>Meaning</i>	<i>Unit</i>	<i>Statistics</i>	
			<i>Mean/SD</i>	<i>Range</i>
<b><i>Energy</i></b>				
MAT	mean annual temperature	$^{\circ}\text{C}$	6.8/8.0	-10.2–25.2
MTWQ	mean temperature of warmest quarter	$^{\circ}\text{C}$	18.4/7.4	2.0–31.0
MTCQ	mean temperature of coldest quarter	$^{\circ}\text{C}$	-6.2/10.1	-28.4–21.1
WI	warmth index = sum of (MMT - 5), MMT > 5 $^{\circ}\text{C}$	$^{\circ}\text{C}$	76.2/54.3	0.0–243.3
PET	potential evapotranspiration (following Thornthwaite & Hare's (1955) method)	mm	630.1/225.8	214.1–1434.7
<b><i>Water</i></b>				
MAP	mean annual precipitation	mm	602.9/517.6	15.8–3260.1
AET	actual evapotranspiration (following Thornthwaite & Hare's (1955) method)	mm	455.9/312.8	15.8–1339.6
PDQ	precipitation of driest quarter	mm	33.9/48.3	0.0–548.4
MI	moisture index (following Thornthwaite & Hare's (1955) method)		-9.7/57.9	-98.1–321.7
WD	water deficit = PET - AET	mm	174.2/231.4	0.0–993.9
<b><i>Climate variability</i></b>				
MDR	mean diurnal range	$^{\circ}\text{C}$	12.1/2.6	5.3 – 17.0
ART	annual range of temperature = max(MMT) – min(MMT)	$^{\circ}\text{C}$	38.9/9.6	15.2–61.0
TSN	temperature seasonality = SD of MMT		9.6/3.0	2.7–16.8
PSN	precipitation seasonality = Coefficient of Variation of MMP		88.7/22.5	28.1–146.1
<b><i>Habitat heterogeneity</i></b>				
TOPO	elevation range	m	1159.9/917.8	14.0–6327.0
RMAT	spatial range of MAT	$^{\circ}\text{C}$	6.4/5.0	0.1–29.5
RMAP	spatial range of AP	mm	171.8/270.7	1.0–3313.0
VEG	number of vegetation formations		9.2/4.6	1-31
VEGH	Shannon-Wiener index of vegetation		1.4/0.6	0-3.0
<b><i>Human disturbance</i></b>				
HPD	human population density	$\text{km}^{-2}$	207.5/346.0	0.4–5137.0
GDP	gross domestic product	$10^4\text{RMB}$	952.0/3409.5	0.8–55379.0
CROP	area of croplands	$\text{km}^2$	541.5/730.4	0.0–2500.0

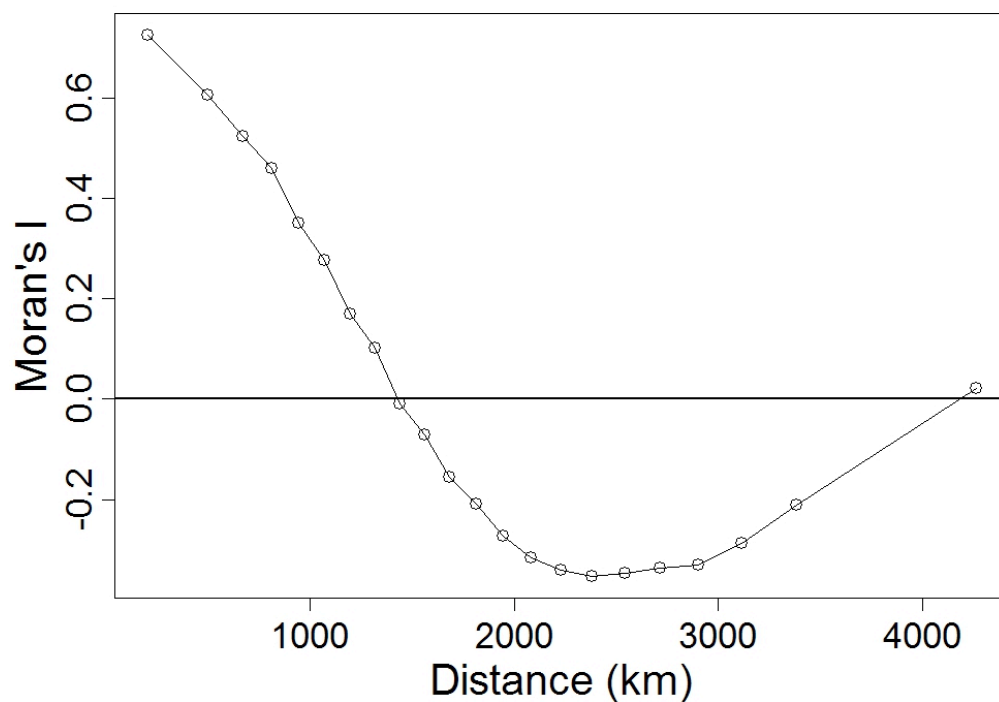
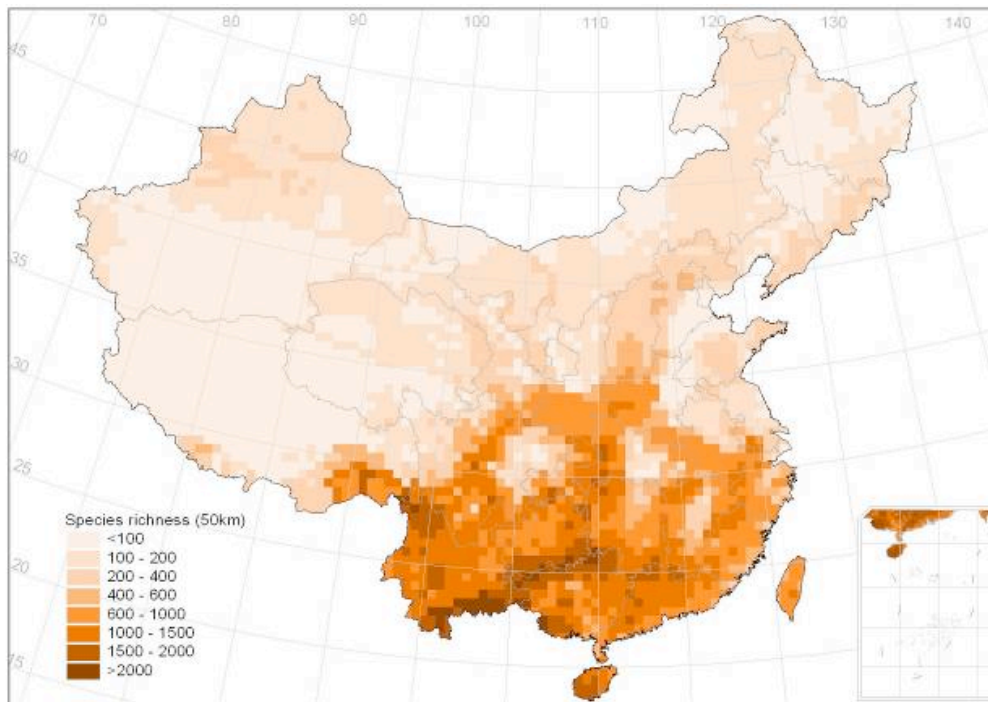
## References

Thornthwaite, C. W. and Hare, F. K. 1955. Climatic classification in forest. — *Unasylva* 9: 51-59.

**Appendix 2** Cumulative proportions of variance explained by the principal component axes in the Principal Component Analysis (PCA) for the five environmental groups.

<b>Principal component axes</b>	<b>PC 1</b>	<b>PC 2</b>	<b>PC 3</b>	<b>PC 4</b>	<b>PC 5</b>
Environmental energy	91.2	98.9	99.9	100.0	100.0
Water availability	87.1	94.6	98.6	99.9	100.0
Climatic seasonality	65.4	91.4	100.0	100.0	-
Habitat heterogeneity	62.3	84.1	96.6	99.7	100.0
Human activities	68.7	90.6	100.0	-	-

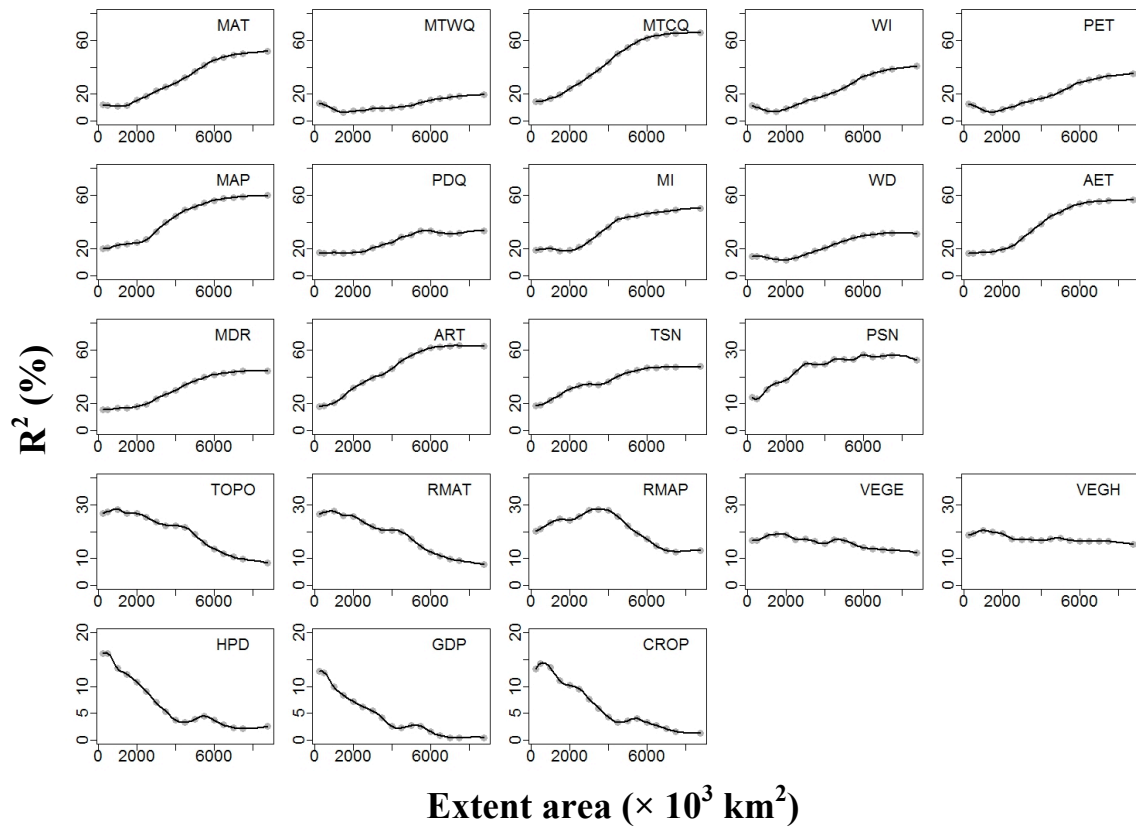
**Appendix 3** Geographical pattern of species richness (A) and its spatial correlogram (B). See also Wang et al (2011) for more details about the species richness patterns of woody plants in China.



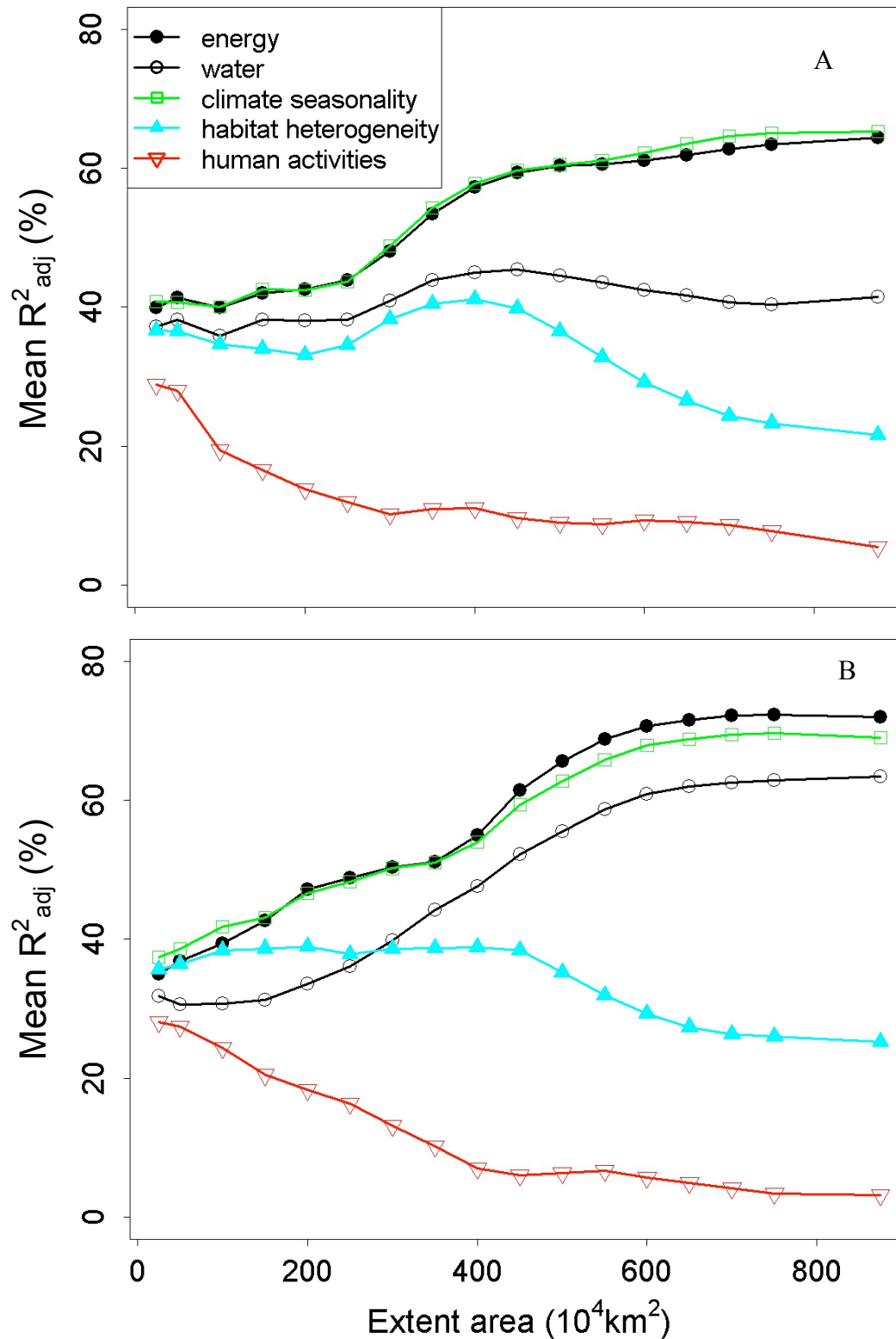
### Reference

Wang, Z. et al. 2011. Patterns, determinants and models of woody plant diversity in China. — Proc. R. Soc. B 278: 2122-2132.

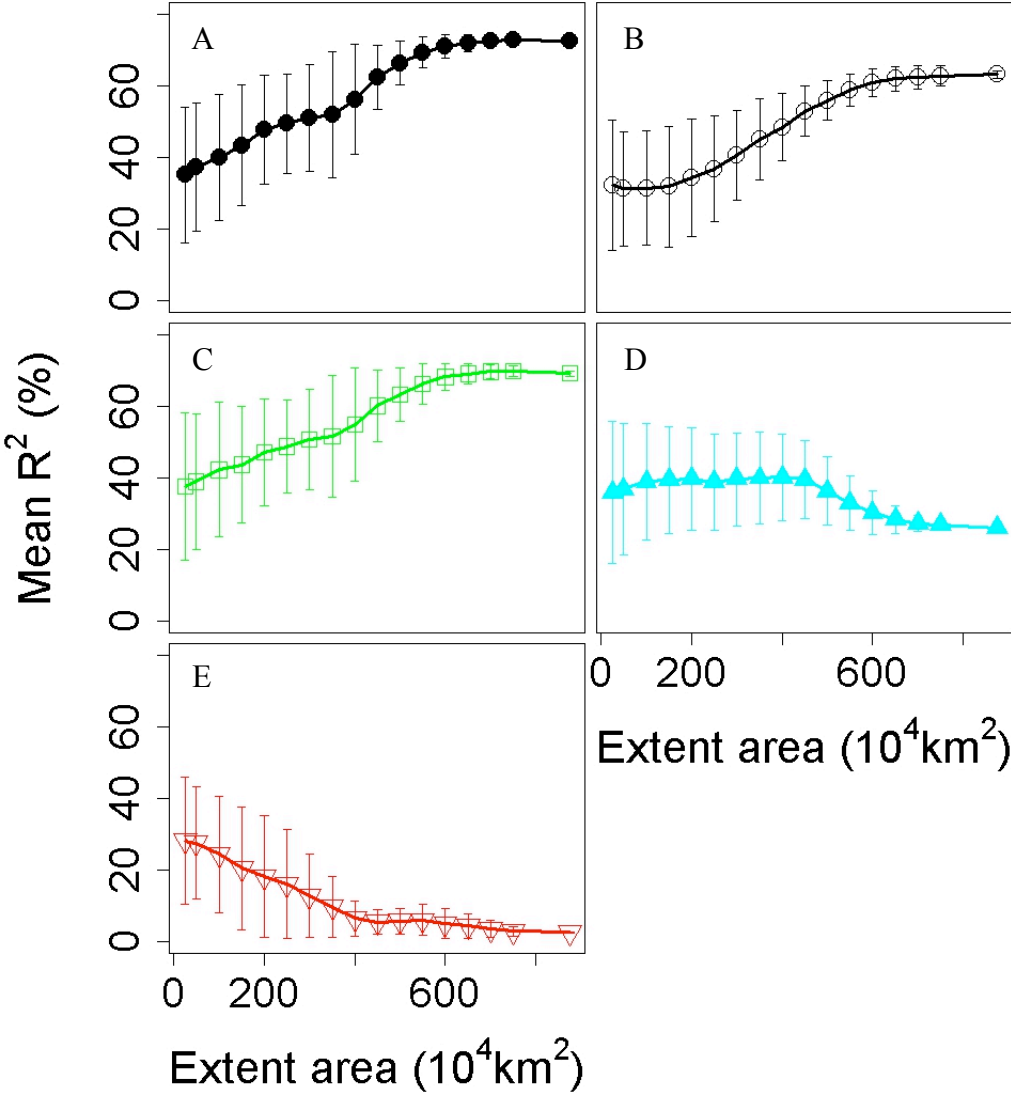
**Appendix 4** Changes in the explanatory power of each individual variable with extent expansion. From top down, the five rows represent the variables of environmental energy, water availability, climatic seasonality, habitat heterogeneity and human activities.



**Appendix 5** Changes in the explanatory power ( $R^2_{adj}$ ) of the five environmental groups on the richness of narrow- (A) and widely-range (B) species. Each  $R^2_{adj}$  at an extent is the average of  $R^2_{adj}$  from 1000 repeated regression models performed in randomly-generated continuous regions using a dye-spread algorithm. Compared with overall species, narrow- and widely-ranged species showed consistent extent dependence.



**Appendix 6 Changes in the explanatory power of different environmental factors with geographical extent. The bars in the figures show 1 and -1 times of the standardized deviation (SD). A, environmental energy; B, water availability; C, climatic seasonality; D, habitat heterogeneity; E, human activities.**



**Appendix 7** Influence of human activities on species richness in the major plains/basin in China.

To further assess the effects of human activities on the richness of China's woody species, we selected the five largest plains/basins in China and performed regression analyses for each region (Figure A1): Northeast Plain (c.a.  $35 \times 10^4 \text{ km}^2$ ), North China Plain (c.a.  $30 \times 10^4 \text{ km}^2$ ), Middle and Lower Reaches of Yangtze River (c.a.  $20 \times 10^4 \text{ km}^2$ ), Sichuan Basin (c.a.  $16.5 \times 10^4 \text{ km}^2$ ) and Pearl River Delta (c.a.  $11 \times 10^4 \text{ km}^2$ ). The results indicate that the effect of human activities in these areas is much higher than that at the extent of the entire country, especially for the Northeast Plain, the Middle and Lower Reaches of Yangtze River and the Pearl River Delta, where 39%-43% of variance in species richness is accounted for by human activities (Table A1). These results further confirm the extent dependency of human activities, and suggest that the effects of human activities on species richness could be significant in specific regions. The Northeast Plain, the Middle and Lower Reaches of Yangtze River and the Pearl River Delta are the regions with the most extensive forestry, agricultural and/or industrial activities in China. Accordingly, human activities can here be expected to have a significant impact on the species richness of woody plants, and effective management and preservation are essential to maintain the species richness of woody species in these regions.

Table A1 The influence of human activities in the main plains/basins.

<b>Regions</b>	<b>Number of grids</b>	<b>Area (<math>10^4 \text{ km}^2</math>)</b>	<b>R<sup>2</sup> (%)</b>
Northeast Plain	134	35	39.8
North China Plain	127	30	8.5
Middle and Lower Reaches Plain of Yangtze River	97	20	39.8
Sichuan Basin	50	16.5	10.6
Pearl River Delta	46	11	43.0



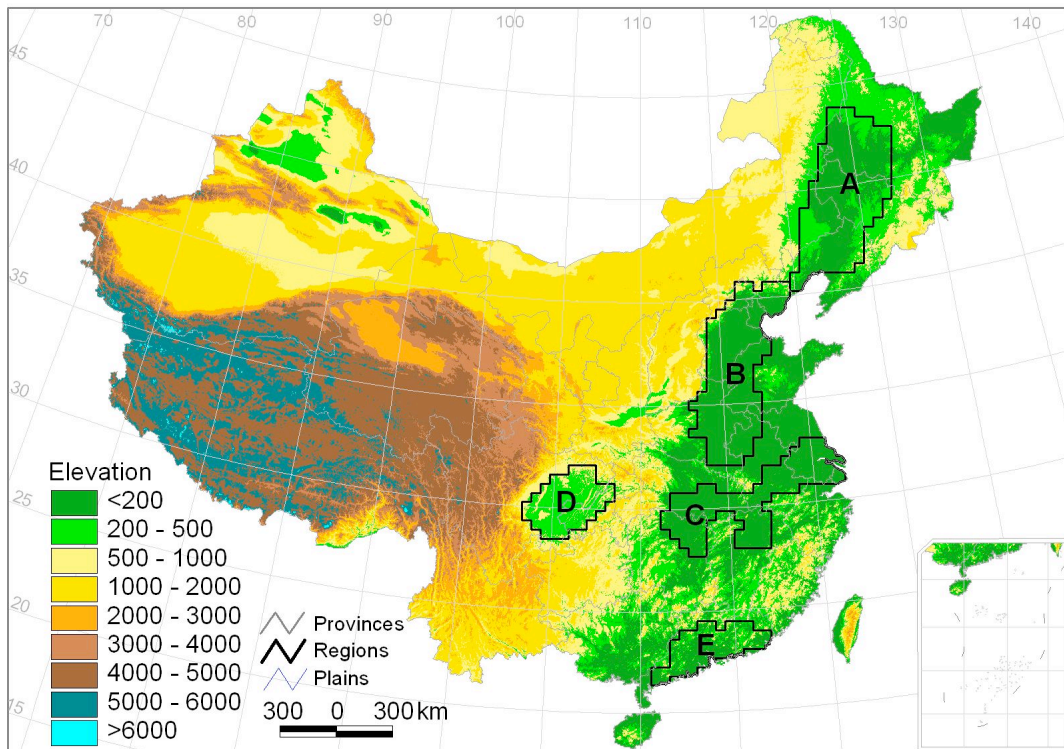


Figure A1 Positions of the major plains/basins in China. A, Northeast China Plain; B, North China Plain; C, Middle and Lower Reaches Plain of Yangtze River; D, Sichuan Basin; E, Pearl River Delta.