

Supplementary Materials

Table S1. Cover area by each climate zone and its proportion in the Yellow River Basin.

Climate zone	Cover area (km ²)	Proportion of sample county area (%)
Subtropical monsoon climate(I)	25156.719	3.438
Subtropical continental monsoon climate(II)	2112.822	0.289
Temperate-subtropical monsoon climate(III)	1365.508	0.187
Temperate monsoon climate(IV)	58475.018	7.992
Temperate continental monsoon climate(V)	282377.698	38.595
Temperate continental climate(VI)	162366.273	22.192
Plateau continental monsoon climate(VII)	21318.222	2.914
Plateau continental climate (VIII)	178463.605	24.392
Total	731635.864	100.000

The total area of each climate zone is smaller than the total area of the YRB because some counties were not included as samples in this study.

Table S2. Forest ecological function subsystem indicators.

Specific indicators	Type division			Weight
	I	II	III	
Forest biomass	≥150 t/hm ² (20)	150 t/hm ² -149 t/hm ² (10)	<150 t/hm ² (6.7)	0.20
Forest naturalness ¹	1,2 (15)	3,4 (7.5)	5 (5)	0.15
Forest community structure ²	1 (15)	2 (7.5)	3 (5)	0.15
Tree species composition ³	6,7 (15)	3,4,5 (7.5)	1,2 (3.3)	0.15
Total vegetation cover ⁴	≥70% (15)	50%-90% (15)	<50% (3.3)	0.10
Canopy closure ⁵	≥0.70 (10)	0.40-0.69 (5)	0.20-0.39 (3.3)	0.10
Average tree height	≥15.0 m (10)	5.0 m-14.9 m (5)	<5.0 m (3.3)	0.10
Dead leaves thickness	1 (5)	2 (2.5)	3 (1.7)	0.05

The numbers within the brackets represent the scores of each factor under different types I, II, and III. When all factors fall under the first type (I), the site obtains the highest score of 100 points; The weights of various factors within this subsystem are based on the recommended weights specified in the Technical Regulations for Continuous Forest Resource Inventory (GB/T 38590-2020) [37]. ¹ The classification criteria for naturalness are based on the difference between the vegetation condition and the original top-level community or the stage of secondary communities in succession [67]. This classification ranges from "1" to "5," with increasing levels of anthropogenic disturbance. ² Forest community structure is categorized from "1" to "3," representing complete structure, relatively complete structure, and simple structure, which indicates the abundance of vegetation layers within the stand, from highest to lowest. ³ In terms of tree species composition, "1,2" denotes pure stands with a single coniferous/broad-leaved tree species accumulation or number ≥90%; "3,4" represents relatively pure stands with a single coniferous/broad-leaved tree species accumulation or number accounting for 65% to 90%; "5,6,7" indicates mixed forests with coniferous tree species accumulation or number ≥65%, mixed forests with broad-leaved tree

species accumulation or number $\geq 65\%$, and mixed coniferous-broadleaved forests where the total accumulation or number of coniferous or broad-leaved tree species accounts for 35% to 65%. ⁴ Total vegetation cover refers to the proportion of the vertical projected coverage area of woody plants, shrubs, and grasses within the plot concerning the plot's total area. ⁵ Canopy closure indicates the proportion of the vertical projected coverage area of tree canopies, bamboo, or sparse forest canopies within the plot to the plot's total area.