Table S1. The categories of *Pinus* L. species, and the numbers of grid cells and records.

Group	Species	Grid cells	Records
Wide-ranged species	*Pinus sylvestris*	3189	273285
	Pinus nigra	1165	19959
	Pinus mugo	858	12196
	Pinus strobus	702	4947
	Pinus pinaster	553	14220
Intermediate species	*Pinus contorta*	451	4053
	Pinus pinea	429	6594
	Pinus halepensis	385	11205
Narrow-ranged species	*Pinus cembra*	355	3982
	Pinus radiata	190	1268
	Pinus banksiana	178	289
	Pinus wallichiana	138	231
	Pinus peuce	124	268
	Pinus ponderosa	99	140
	Pinus heldreichii	59	317
	Pinus canariensis	49	120
	Pinus brutia	41	780

Table S2. All variables and their abbreviations used in our study.

Groups	Abbreviations	Variables
Environmental energy	MAT	Mean annual temperature (°C)
	MDR	Mean diurnal temperature range (°C)
	Iso	Isothermality (°C)
	Tmax	Max temperature of warmest month (°C)
	Tmin	Min temperature of coldest month (°C)
	MTWEQ	Mean temperatures of wettest quarter (°C)
	MTDQ	Mean temperatures of driest quarter (°C)
	MTWQ	Mean temperatures of warmest quarter (°C)
	MTCQ	Mean temperatures of coldest quarter (°C)
	PET	Potential evapotranspiration (mm)
Water availability	MAP	Annual precipitation (mm)
	PWM	Precipitation of the wettest month (mm)
	PDM	Precipitation of the driest month (mm)
	PWQ	Mean precipitation of wettest quarter (mm)
	PDQ	Mean precipitation of driest quarter (mm)
	PWAQ	Mean precipitation of warmest quarter (mm)
	PCOQ	Mean precipitation of coldest quarter (mm)
	AET	Annual actual evapotranspiration (mm)
	AI	Aridity index
	WD	Water deficit (mm)
Climatic seasonality	TSN	Temperature seasonality
	PSN	Precipitation seasonality
Climate change since LGM	TA	Temperature absolute anomaly (°C)
	PA	Precipitation absolute anomaly (mm)
Soil texture	BDOD	Bulk density (kg/dm^3)
	CLAY	Clay content (%)
	CFVO	Coarse fragments volumetric (%)
	SILT	Silt content (%)
	SAND	Sand content (%)
Soil fertility	CEC	Cation exchange capacity (cmolc/kg)
	OCD	Soil organic carbon density (kg/dm^3)
	OCS	Soil organic carbon stock(kg/dm^2)
	SOC	Soil organic carbon content (g/kg)
	N	Total nitrogen (g/kg)
	pH	Soil pH
Habitat heterogeneity	ELER	Elevational range (m)
Human activities	HFP	Human footprint

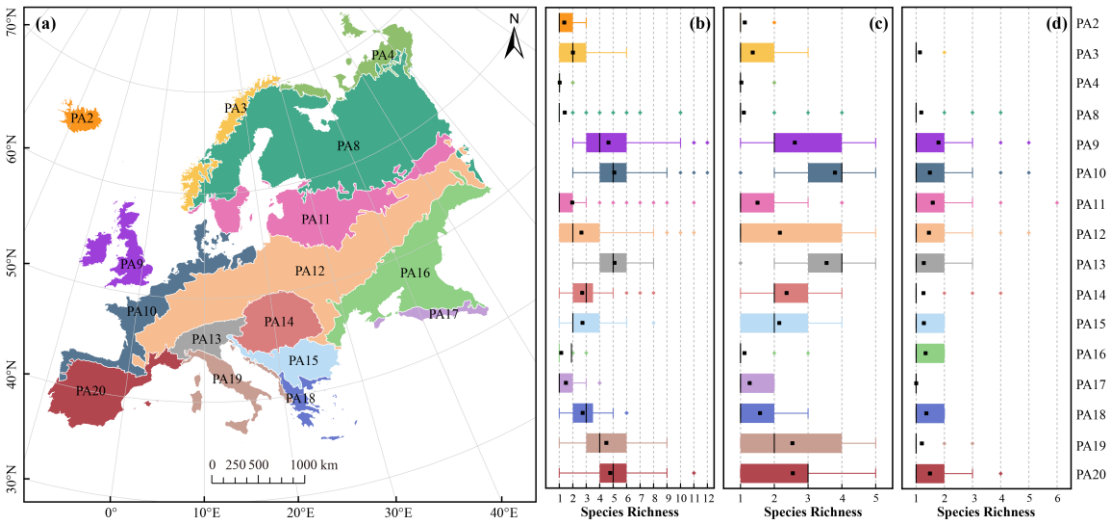

Figure S1. Distribution of 16 biological regions in Europe and statistical results of *Pinus* L. species richness in each region. (a) Spatial distribution map of 16 bioregions, (b) Overall species, (c) Wide-ranged species, (d) Narrow-ranged species. The bioregion names are as follows: PA2, Iceland; PA3, Scandinavian Birch & Coastal Conifer Forests; PA4, Greater Eurasian Tundra; PA8, Ural Mountains & West Eurasian Taiga Forests; PA9, Great Britain, Ireland & Faroe Islands; PA10, West European Coastal Mixed Forests; PA11, Baltic Sea & Sarmatic Mixed Forests; PA12, European Interior Mixed Forests; PA13, Alps & Po Basin Mixed Forests; PA14, Carpathian Mountain & Plains Mixed Forests; PA15, Dinaric Mountains & Balkan Mixed Forests; PA16, Pontic Steppe Grasslands; PA17, Black Sea, Caucasus-Anatolian Mixed Forests & Steppe; PA18, Aegean Sea & East Mediterranean Mixed Forests; PA19, Adriatic Sea & Central Mediterranean Mixed Forests; PA20, Balearic Sea & West Mediterranean Mixed Forests.

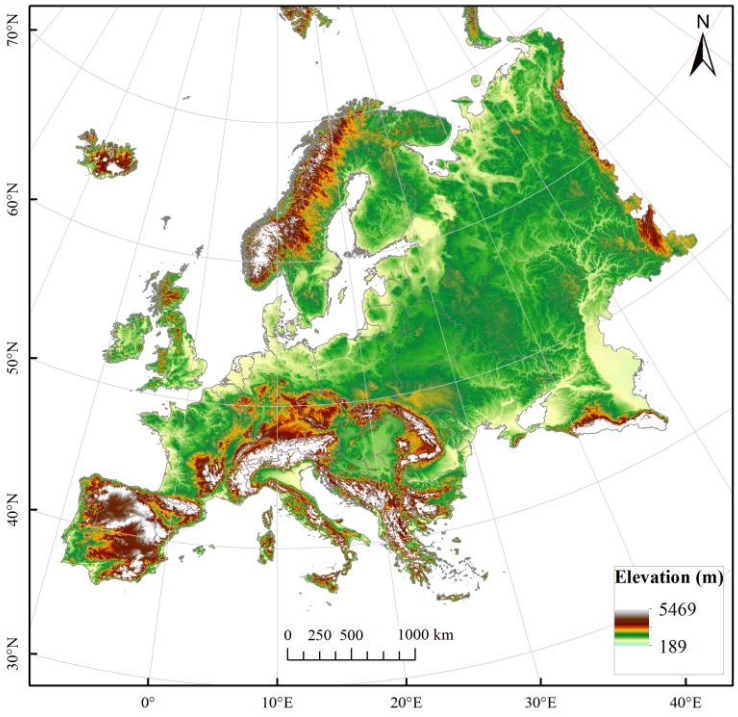

Figure S2. The topographic map of Europe.