Supplementary Materials

Table S1. Comparison of linear and generalized additive models (GAM) for the optimal climate variables across elevation groups. The table shows model comparison results for the best climate variables identified for each elevation group. R^2 squared values indicate the proportion of variance explained, and AIC are Akaike Information Criterion values.

Altitude Group	Model Type	R^2 Squared	AIC
Low	Linear	0.601	80.48
Low	GAM	0.6584	80.10
Mid	Linear	0.3684	75.17
Mid	GAM	0.5556	60.24
High	Linear	0.3717	39.84
High	GAM	0.3717	39.84

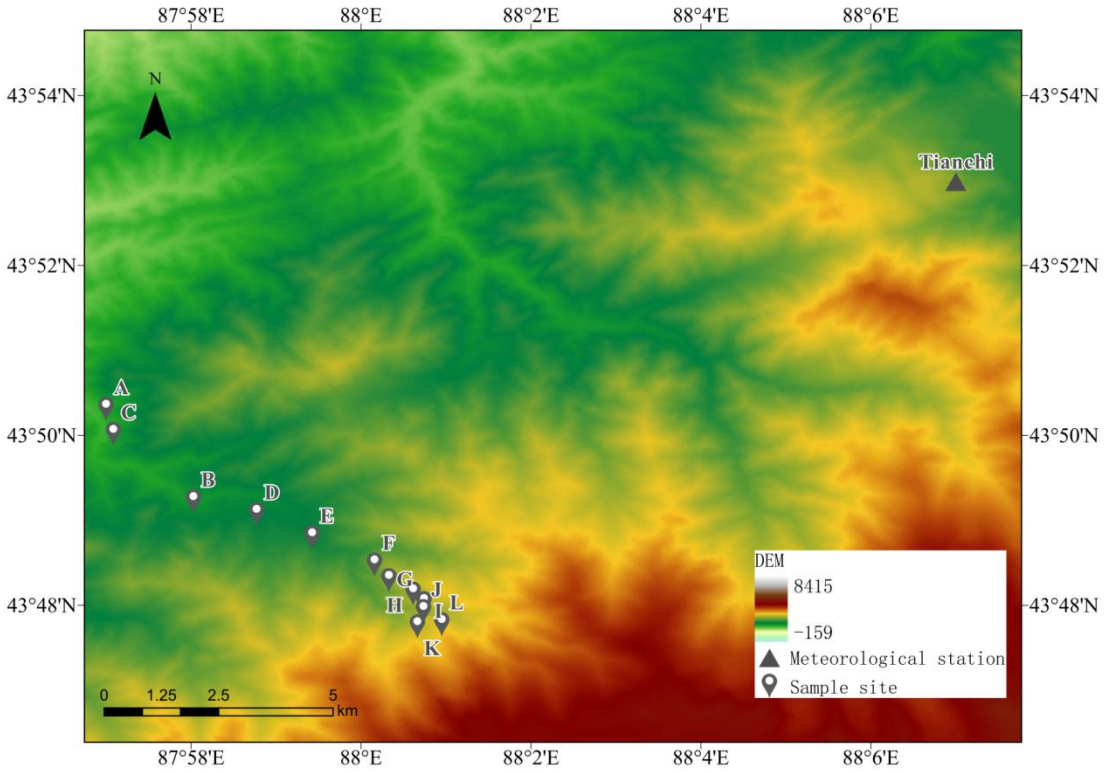


Figure S1. Map showing the location of sampling sites and the Tianchi meteorological station.

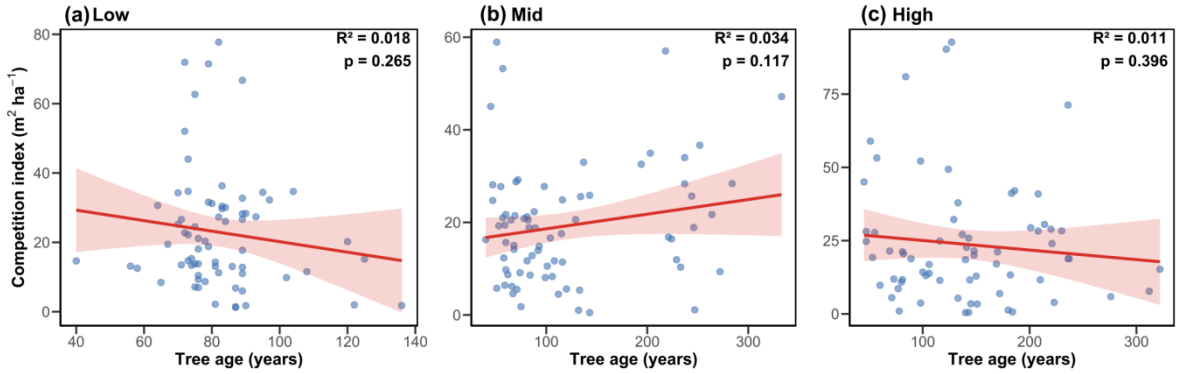


Figure S2. Linear relationships between tree age (years) and competition index (m^2 ha^{-1}) for (**a**) Low-, (**b**) Mid-, and (**c**) High-altitude groups. Red lines represent linear fits with 95% confidence bands.

R^2 and p-values are shown for each group, indicating non-significant age-competition relationships across all altitudes.

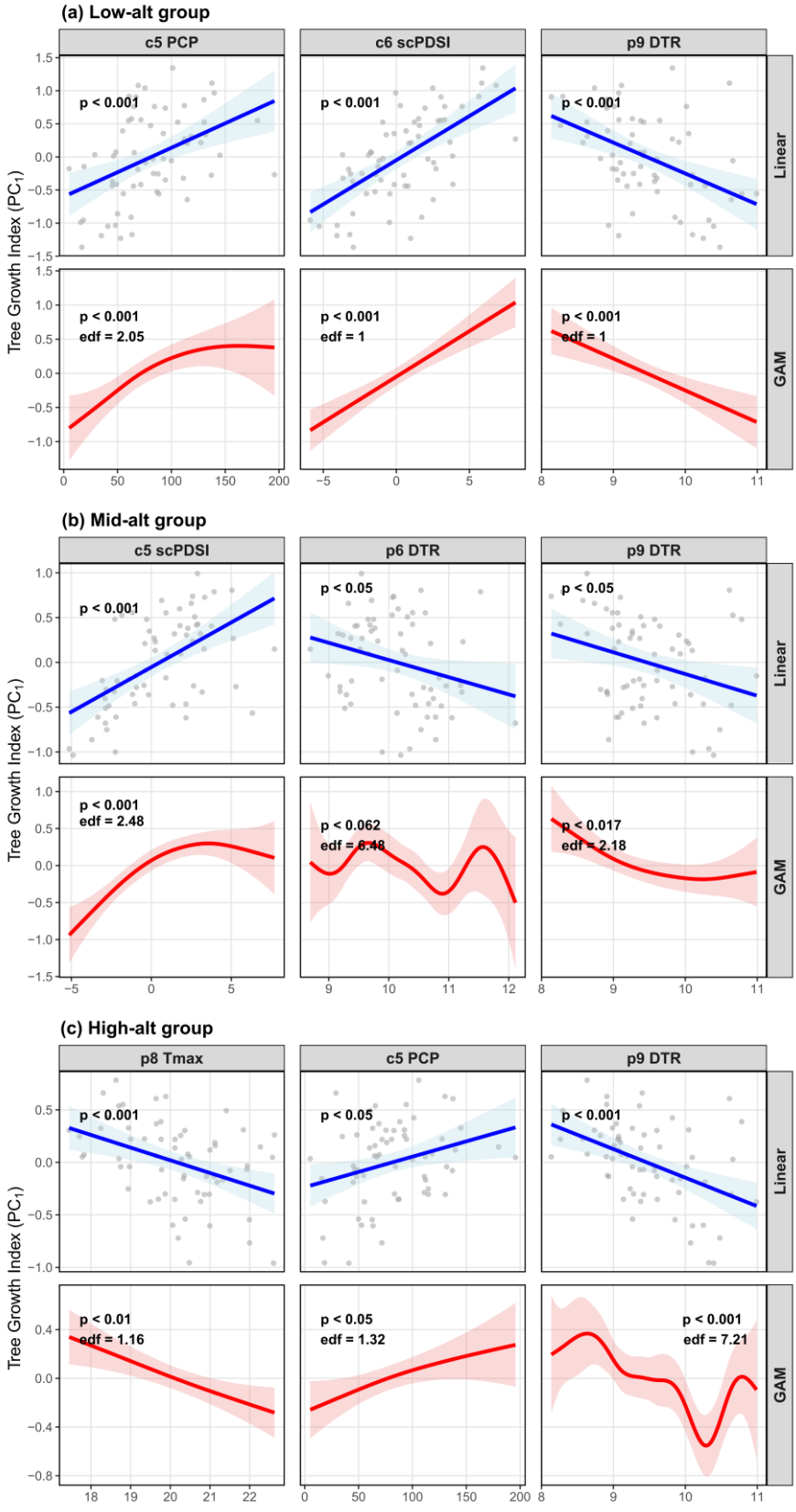


Figure S3. Comparison of effect plots between multiple linear regression models and GAMs for three altitude groups: (**a**) Low-altitude, (**b**) Mid-altitude, and (**c**) High-altitude. For each group, the upper row shows partial regression plots from linear models, while the lower row displays smooth

term plots from GAM. Blue lines represent linear effects with 95% confidence intervals and p-values. Red curves show GAM smooth functions with gray confidence bands, p-values, and effective degrees of freedom (edf). Variable definitions follow Figure 7.