Supplementary materials

Prolonged limitation of tree growth due to warmer springs in semi-arid mountain forests of Tianshan, northwest China

Xiuchen Wu¹*, Hongyan Liu¹*, Yufu Wang², Minghua Deng²

¹Department of Ecology, College of Urban and Environmental Sciences, and MOE Laboratory for Earth Surface Processes, Peking University, Beijing, 100871, China
²Department of Probability and Statistics, School of Mathematical Sciences, Peking University, Beijing, 100871, China

*Correspondence author should be addressed: wuxiuchen2000@163.com; lhy@urban.pku.edu.cn

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Figure S1-S5 and figure captions.
Figure S1. A Residual tree ring chronologies for the nine plots and the first principal component (PC1) for the period 1933-2005. B Scatter plots of principal component analysis (PCA) loadings of the nine residual chronologies for the period 1933-2005.
**Figure S2.** Regional mean temperature series for February-July during 1951-2005. Straight lines are the linear fits for temperature series. Significant increase trends are observed in temperature series for February, March and April with warming rates of 0.88, 0.50 and 0.33 °C/10 years ($p < 0.05$), while temperature does not show a significant increase trend in May, June and July. Temperature data used in this analysis is derived from CRU TS 3.1 (Climate Research Unit, http://www.cru.uea.ac.uk/).
Figure S3. Total monthly precipitation series for February-July during 1951-2005. Straight lines are the linear fits for precipitation series. Precipitation in this region showed great interannual variations but did not change markedly except a significant increase trend in July ($p < 0.05$, equation not shown). Precipitation data used in this analysis is derived from CRU TS 3.1 (Climate Research Unit, http://www.cru.uea.ac.uk/).
Figure S4. Comparison of the regional mean growing season NDVI (blue line, 1982-2006) and the regional mean basal area increment (BAI, green line, 1933-2005).
Figure S5. Comparison of anomalies of regional early spring (March-April) PDSI (blue line) and anomalies of regional mean basal area increment ($\text{BAI}_{\text{region}}$, green line) during 1933-2005. The anomalies of early spring PDSI and anomalies of $\text{BAI}_{\text{region}}$ is relative to the mean values of March-April PDSI and mean values of $\text{BAI}_{\text{region}}$ during 1933-2005, respectively. The regional mean basal area increment is calculated by averaging the nine raw BAI series for the nine sampling sites.