

2. 树木年轮与全球变化

Nitrogen availability and iWUE have modulated the radial growth of temperate evergreen and deciduous trees near expanding city over past 100 years

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摘要: Understanding the dynamic growth response of trees to climate and environment changes near to expanding city is crucial for appropriate management in maintain forest structure, functionality, and ecological service. The northern Qinling Mountains in China, identified as a climate-sensitive region with a rising trend in NO_x and PM_{2.5} emissions, particularly in areas near to the expanding city such as Xi'an city, receiving the strong nitrogen deposition in recent decades. Used tree-ring width measurements (basal areal increment, BAI), carbon ($\delta^{13}\text{C}$) and nitrogen ($\delta^{15}\text{N}$) isotope, as well as C/N, we explore the effects of climates, intrinsic water-use efficiency (iWUE) and nitrogen availability on tree species, including chestnut (*Castanea mollissima*), oak (*Quercus aliena*) and pine (*Pinus tabulaeformis*), closing to expanding Xi'an city. Our findings indicate that in northern Qinling region, radial growth of two deciduous tree species accelerated during past two decades compare to evergreen pine. Tree radical growth of oak and pine trees has been primarily influenced by intrinsic water-use efficiency (iWUE) and $\delta^{15}\text{N}$ over the past century, and seems to have been affected by the CO₂ fertilization effect. Tree-ring $\delta^{15}\text{N}$ of pine declined continuously over past 100 years, comparing to differing starting year around 1980s of two deciduous tree species. From 1970 to 2018, broadleaf and deciduous trees exhibited significant responses to iWUE and $\delta^{15}\text{N}$ ($p < 0.05$), whereas in coniferous pine trees, the individual effects of iWUE and $\delta^{15}\text{N}$ were weaker ($p > 0.05$). When considering enhanced nitrogen deposition, NO_x significantly promoted the growth of all three tree species, and the individual effects of NO_x on BAI of three tree species were all significant ($p < 0.05$). Our results contribute to a better understanding of the radial growth response of broadleaf and coniferous trees to urban expansion, providing valuable insights for evaluating the interactions between forest carbon and nitrogen under the influence of climate and environmental changes.

关键词: Tree radial growth, stable carbon and nitrogen isotopes, CO₂ fertilization, nitrogen availability, enhanced environment stress.