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Growth and drought resilience of planted conifers and broadleaves in the semi-arid Northern China.

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Under warmer and drier climate scenarios, the growth and resilience of forests will be critically affected by more frequent and severe droughts. Since the 1970s, China has launched several afforestation programs aimed at regional ecological protection, playing an important role for reaching carbon neutrality by 2060.

This study provided a detailed analysis of the growth suitability of the main planted conifers (*Pinus sylvestris* var. *mongolica*, *Pinus tabulaeformis*) and broadleaves (*Populus* spp., *Robina pseudoacacia*) in the semi-arid northern China. We compared the radial growth trends of plantations and their responses to extreme droughts from 1980 to 2018.

Growth of most plantations has significantly increased, but broadleaves showed recent growth reductions in the past decade, which may be related to tree age and reduced soil water content. Nevertheless, under warmer climate scenarios, growth of plantations is forecasted to continue increasing. Broadleaves showed a better post-drought recovery, probably linked to their anisohydric behavior, than conifers, which presented a better resistance to drought. Growth of conifers depended more on warmer temperature and better precipitation conditions during the growing season, whereas broadleaves mainly reacted to warm temperature. Additionally, pre-drought growth levels weakened resilience components, while post-drought precipitation compensated drought-induced growth deficit. Growth and resilience were negatively related to tree age, whilst higher stand density reduced growth. This assessment and projections of growth and drought resilience indicate the sustainability of most plantations in semi-arid regions, but future warmer and drier conditions may lead to an uncertain future regarding forest health and reduce their carbon sink potential.

Keywords: Growth trends; Drought resilience; Tree-ring analysis; Plantations; Three-North Shelter Forests Program.