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Predicting the responses of forest to climate change under RCPs scenarios in southern China

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Global climate has been experiencing unprecedented warming. This warming has and will continue to significantly influence the structure and function of forest ecosystems. While studies have been conducted to explore the possible responses of forest landscapes to future climate change, the Representative Concentration Pathways (RCPs) scenarios under the framework of the Coupled Model Intercomparison Project Phase 5 (CMIP5) have not been widely used in quantitative modeling research of forest landscapes. We used LANDIS-II, a forest dynamic landscape model, coupled with a forest ecosystem progress model (PnET-II), to simulate spatial interactions and ecological succession processes under RCPs scenarios, RCP2.6, RCP4.5 and RCP8.5 respectively. We also modelled a control scenario of extrapolating current climate conditions to examine changes in distribution and aboveground biomass (AGB) among five different forest types for the period of 2010-2100 in Taihe County in southern China, where subtropical coniferous plantations dominate. The results of the simulation show that climate change will significantly influence forest distribution and AGB. (i) Evergreen broad-leaved forests will expand into Chinese fir and Chinese weeping cypress forests. The area percentages of evergreen broad-leaved forests under RCP2.6, RCP4.5, RCP8.5 and the control scenarios account for 18.25%, 18.71%, 18.85% and 17.46% of total forest area, respectively. (ii) The total AGB under RCP4.5 will reach its highest level by the year 2100. Compared with the control scenarios, the total AGB under RCP2.6, RCP4.5, RCP8.5 increase by 24.1%, 64.2% and 29.8%, respectively. (iii) The forest total AGB increases rapidly first and then decrease slowly on the temporal dimension. (iv) Even though the fluctuation patterns of total AGB will remain consistent under various future climatic scenarios, there will be certain responsive differences among various forest types.