

Mixing *Pinus thunbergii* and *Robinia pseudoacacia* does not enhance the understory vegetation biomass and diversity

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Abstract:

Understory vegetation is an indispensable part of forest ecosystem. Based on the field data of 36 sample plots of Japanese black pine (*Pinus thunbergii*)–black locust (*Robinia pseudoacacia*) mixtures and their respective Japanese black pine and black locust monocultures in temperate forest plantations in Laoshan Mountain of eastern China, this study analyzed the effects of mixing black pine and black locust on the understory biomass and its diversity (e.g., Shannon-Wiener index) and soil carbon (C) and nitrogen (N), and we assessed the associations between understory biomass and species diversity, the C and N content in soil at the plot level (20 m × 30 m). We also used correlation analysis to explore the underlying mechanism by which tree diversity drives the understory diversity and the C and N content in soil. The results showed that species mixture had no significant effect on the understory biomass, and there was a large gap between the biomass of shrub, herb and seedling with the greater biomass of herb than those of shrub and seedling. The diversity of shrub in the black locust pure forests was significantly higher than black pine pure forests and their mixed forests; no significant difference was detected in herb and seedling diversity among the mixed stands and their respective monocultures except for significantly higher evenness in mixtures. It was found that the diversity of shrub and herb of all three stands was generally negatively correlated with stand age and stand density and diversity of herb in black pine pure stands and mixtures showed positive correlations with stand basal area while negative correlations in black locust monocultures, indicating the decrease of diversity as the stands developed. The biomass of shrub was significantly positively correlated with the content of carbon and nitrogen in shallow soil (0–5cm), while the correlation between herb diversity and biomass and stand structure and soil physical and chemical properties was weak. This study demonstrates that establishing Japanese black pine and black locust mixed-species plantations does not necessarily enhance the biomass and diversity of understory vegetation, but increase the low soil nutrient of black pine monocultures which occupy a large proportion of forest areas in Laoshan and Shandong Peninsula.

Key words: Tree mixture; Forest plantations; Understory plant diversity; Biomass; Laoshan