

Effect of Black Locust Trees on the Nitrogen Dynamics of Black Pine Trees in Shonai Coastal Forest, Japan

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Abstract : Aims: Black pine coastal forests play an important role as a windbreak and as a natural barrier to sand and salt spray inland in Japan. The recent invasion of N₂-fixing black locust (*Robinia pseudoacacia*) trees in these forests is expected to have a nutritional contribution to black pine trees growth. Thus, the effect of this new source of N on black pine trees' N assimilation needs to be assessed. Methods: In order to evaluate this contribution, tree-ring isotopic composition ($\delta^{15}\text{N}$) and nitrogen content (%N) of black pine (*Pinus thunbergii*) trees in a pure stand (BPP) and a mixed stand (BPM) with black locust (BL) trees were measured for the period 2000–2019 for BPP and BL and 1990–2019 for BPM. The same measurements were conducted in plant tissues and in soil samples. Results: The tree ring $\delta^{15}\text{N}$ values showed that for the last 30 years, BPM trees gradually switched from BPP to BL-derived soil N starting in the 1990s, becoming the dominant N source from 2000 as no significant difference was found between BPM and BL tree ring $\delta^{15}\text{N}$ values from 2000 to 2019. No difference in root and sapwood BPM and BL $\delta^{15}\text{N}$ values were found, but BPM foliage (–2.1‰) was different to BPP (–4.4‰) and BL (–0.3‰), which is related to the different N assimilation pathways between BP and BL. Conclusions: Based on the results of this study, the assimilation of BL-derived N inferred from the BPM tissues' $\delta^{15}\text{N}$ values is the result of an increase in soil bioavailable N with a higher $\delta^{15}\text{N}$ value.

Keywords : nitrogen-15, N₂-fixing species, mixed stand, soil, tree rings

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