Variation of two Haloxylon species along a gradient of groundwater depth at the transition zone between desert and oasis

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Abstract

Haloxylon species were dominant vegetation components of deserts across Central Asia, considering as typical desert plants. Recent studies based on stable isotope showed that they are groundwater-dependent plants, but their tolerance strategies and limits to groundwater variation remain unknown. We adopted the method of spatial-for-temporal, took Haloxylon ammodendron and H. persicum in Gurbantunggut Desert in Central Aisa as study objects, combined field survey with model estimation exploring their quantity, structure, age, and biomass characteristics along a natural groundwater gradient, aiming to reveal responses to groundwater depth changes and predict their future development. The results showed that: (1) Along the groundwater gradient, the stand density, and plant height, canopy width, and basal diameter of two species all decreased significantly. (2)When the groundwater depth descended to lower than 12 m, H. persicum replaced H. ammodendron becoming the more dominant species. (3) As the groundwater depth declined, the dominant diameter class of H. ammodendron increased, its percentage of adult individuals increased, but H. persicum was always dominated by young trees. (4) The above-ground, below-ground and total biomass of two species were all going down with the lowering of groundwater table, especially those of H. ammodendron exhibited a much sharper decline, while the root-to-shoot ratio of H. persicum increased more significantly (p < 0.05). These findings indicated that continuous decline in groundwater depth greatly limited the survival and development of H. ammodendron, the strong allocation regulation of H. persicum helped to cushion the adverse effects at a certain extent. In the long run, decreased accessibility of groundwater would be not conducive to their various ecological roles. The obtained results in this study could provide a scientific basis for the protection and management of these valuable species.

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