

Variation in Water Utilization of Typical Desert Shrubs in a Desert-Oasis Ecotone

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Abstract : Water is one of the most important factors limiting plant growth and development in desert ecosystems. In order to understand how desert shrubs cope with variation in water sources over time, it is important to understand plant-water relations in desert-oasis ecotone. We selected the typical desert shrubs: *Nitraria sibirica*, *Calligonum mongolicum* and *Haloxylon ammodendron* of 5-, 10-, 20- and 40-year old as the research species, to study the seasonal variation of plant water sources and response to precipitation in the desert-oasis ecotone of Linze, Northwestern China. We examined stable isotopic ratios of oxygen ($\delta^{18}O$) in stem water of desert shrubs as well as in precipitation, groundwater, and soil water in different soil layers and seasons to determine water sources for the shrubs. We found that the *N. sibirica* and *H. ammodendron* of 5-, 10-year old showed significant seasonal variation characteristics of $\delta^{18}O$ value of stem water and water sources. However, the *C. mongolicum* and 20- and 40-year *H. ammodendron* main water sources were from deep soil water and groundwater, and less response to precipitation pulse. After 22.4 mm precipitation, the contribution of shallow soil water (0-50cm) to the use of *N. sibirica* increased from 6.7% to 36.5%; the *C. mongolicum* rarely use precipitation that were about 58.29% and 23.51%, absorbed from the deep soil water and groundwater; the contribution of precipitation to use of *H. ammodendron* had significantly differences among the four ages. The *H. ammodendron* of 5- and 10-year old about 86.3% and 42.5% water sources absorbed from the shallow soil water after precipitation. However, the contribution to 20- and 40-year old plant was less than 15%. So, the precipitation was one of the main water sources for desert shrubs, but the species showed different water utilization. We conclude that the main water source of the *N. sibirica* and *H. ammodendron* of 5-, 10-year was soil water recharged by precipitation, but the deeply rooted *H. ammodendron* of 20- and 40-year-old and the *C. mongolicum* have the ability to exploit a deep and reliable water source.

Keywords : water use pattern, water resource, stable isotope, seasonal change, precipitation pulse

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