

Depletion-refilling course of water storage in stem may be diel routinely rather than only in drought condition

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Trees in arid and semi-arid regions are faced with water shortages at most times, and the use of water storage in tree stem is an important pathway for adaptation to drought. In this research, we explored the Scotch Pine in semi-arid areas by continuous monitoring and analysis of the sap flow fluxes at the breast height and at the base of the crown in the main growing season. The results showed that in sunny days of the growing season (typical sunny day, soil non-arid), the start time of sap flow at the base of the crown was later than that at the breast height (the maximum of time lag is about 60 mins), the daily sap flow peak time was delayed for 1-2 h. Maximum daily flux at the base of the crown is about 1.4-2.1 times of the flux at the breast height. The depletion of stem water storage mainly occurs in early morning, and then enters the refilling phase in the afternoon. In a sunny day, with the increase of soil water deficit ($REW < 0.43$), tree demand for water storage of stem was more significant, and the main function was the depletion process. When the soil moisture condition was improved with more water resource, the process was dominated by replenishing. From the results of continuous observations throughout the growing season, we can see that the depletion and refilling processes can be balanced in a short period of time (in a few days). This research increased the understanding of the utilization mechanism and utilization time of tree stem storage water in semi-arid areas.