

Water Consumption Characteristics and Optimum Densities Selection of Two Stands Trees in Southern Mu Us Desert

SUMMARY

Field investigation and experiment have conducted on study sites, which are located in southern Mu Us desert. Based on the current stands structure and site conditions, the transpiration traits of *Hedysarum scoparium* and *Pinus sylvestris* var. *mongolica* trees have primarily studied. Meanwhile, the hydrology effects of litter and soil layer, the relationship between rainfall retention capacity and stand structural status under different densities of artificial *Pinus sylvestris* var. *mongolica* plantations have further investigated. The main results are the following:

1. During the growing season of the year 2011, stem heat balance method applied to *Pinus sylvestris* var. *mongolica* and *Hedysarum scoparium* species in Yanchi research station. Results indicated that sap flow varied regularly during the diurnal and seasonal term, which affected by their psychological activities and climate changes. During the measurement time, nighttime sap flow rates were substantial. The major duration of water recharging was from sunrise to midnight (18:00~22:00 pm) due to the water depletion caused by daytime transportation.

2. Redundancy and Kendall's tau analysis showed that in the *Pinus sylvestris* var. *mongolica* woodland 0.2~0.8 m soil layer contributed to most of the plant transpiration, while solar radiation and photosynthetic active radiation had great influence on sap flow of *Hedysarum scoparium*. Air temperature and vapor pressure deficit had impact on nocturnal sap flow rate of *Hedysarum scoparium*. During our studies, nighttime water recharge was more highly influenced by tree features especially in the smaller size diameter shrub.

3. According to the amount of measured effective rainfall, soil surface evaporation and plant water consumption. The least water nourishment area and least water nourishment area for two species were calculated. The least water nourishment area for *Hedysarum scoparium* (25 mm, 16 mm, 13 mm and 9 mm) with different stems were 5.2 m², 2.0 m², 1.60 m² and 0.85 m² respectively, the least water nourishment area for *Pinus sylovestris* var. *mongolica* was 12.0 m². The water tolerant for *Hedysarum scoparium* was 1250 trees per hm² and water tolerant for *Pinus sylvestris* var. *mongolica* was 833 trees per hm².

4. Drawing from the conclusions of factor and canonical correlation analysis, the plot 1 (925 trees per hm²) of Yulin sandy botanical psammophyte protection base was sorted out as the optimal performance of stand structure and rainfall distribution function factors.

Considering above, in southern Mu Us area, *Pinus sylvestris* var. *mongolica* planting density must be controlled within the range of 833~1000 trees per hm², which plays better ecological benefit of rainfall redistribution, stand structure and optimal water use efficiency.