

## **Soil water balance of rain-feed *Pinus sylvestris* var. *mongolica* sand-fixing forest**

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China's Three North program has produced a large area of lined forest in the semi-arid regions. Wind-breaking and sand-fixing forest have successfully slowed down the incursion of desert. In semi-arid regions, rain-feed sand-fixing forest can profoundly influence the fragile ecological environment. This study uses the 30-year-old lined *Pinus sylvestris* var. *mongolica* sand-fixing forest in the eastern part of Mu Us Sandyland as an example to study the water balance of wind-breaking and sand-fixing forest in semi-arid regions. New lysimeter and soil moisture sensors are used to monitor *Pinus sylvestris* var. *mongolica* forest's precipitation, soil moisture and deep soil recharge (DSR), and they provide an accurate annual moisture distribution of rain-feed *Pinus sylvestris* var. *mongolica*. The study shows that there are two obvious moisture recharge processes within an annual base for the *Pinus sylvestris* var. *mongolica* forest soil in Mu Us Sandyland: the snow melted water infiltration-recharge process in the spring, and the precipitation-recharge process in the summer. For instance, it is found that the recharging depth of spring snow melted water is 160cm in 2016. The summer precipitation recharge process results in DSR, recharging soil moisture for layers below 200cm, and the DSR of 2016 is 1.4mm. When the precipitation intensities are 2.6mm/d, 3.2mm/d, 3.4mm/d, 8.2mm/d, 8.2 mm/d, and 13.2mm/d, the respective moisture fronts can reach 20cm, 40cm, 80cm, 120cm, 160cm, and 200cm deep soil layers. This study accurately monitors the rain-feed *Pinus sylvestris* var. *mongolica* forest's annual moisture distribution, confirms the possibility to develop limited forestry in semi-arid region, and provides data support for future forestry development in arid and semi-arid regions.