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## Soil moisture decline following the plantation of Robinia pseudoacacia forests: Evidence from the Loess Plateau

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Soil moisture is the foundation of ecosystem sustainability in arid and semi-arid regions, and the spatial-temporal details of soil moisture dynamics of afforested areas can benefit for land use management in watershortage regions such as the Loess Plateau of China. In this study, spatial-temporal variations in soil moisture under Robinia pseudoacacia plantations on the Loess Plateau were analyzed. A total of 147 observations of soil moisture content (SMC) data to a depth of 500 cm soil profile were collected in 23 counties via field transect surveys and analyses of published literature. The results suggested that (1) the depth-averaged SMC was generally lower under forest sites than under cropland, both in the shallow layers and in the deep profiles. This finding implied that, compared with the native vegetation, the introduced *R. pseudoacacia* plantations caused intense reductions in soil moisture. (2) SMC was positively correlated with climatic factors (mean annual precipitation (MAP), mean annual temperature (MAT), and the Palmer drought severity index (PDSI)), indicating that the SMC under *R. pseudoacacia* plantations was highly consistent with the hydrothermal conditions at the regional scale. (3) The decreasing amplitude of SMC was linearly related to the increasing number of restoration years, especially in the areas below the 500–550 mm precipitation threshold. This finding showed that the restoration ageing sequence was an influential factor that affected the regional SMC variation in *R. pseudoacacia* plantations on the Loess Plateau. Our results suggest that afforestation activities should be avoided if the local total precipitation is insufficient for replenishing the soil moisture and that local tree species with a lower demand for water resources should be considered a top priority for further afforestation of the Loess Plateau.