

Effects of land use pattern on soil water in revegetation watersheds in semi-arid Chinese Loess Plateau

Lei Yang, Liding Chen, and Wei Wei

State Key Laboratory of Urban and Regional Ecology, Research Center for Eco-Environmental Sciences, Chinese Academy of Sciences, Beijing, China (leiyang@rcees.ac.cn)

Soil water stored below rainfall infiltration depth is a reliable water resource for plant growth in arid and semi-arid regions. For decreasing serious soil erosion, large-scale human-introduced vegetation restoration was initiated in Chinese Loess Plateau in late 1990s. However, these activities may result in excessive water consumption and soil water deficit if no appropriate scientific guidance were offered. This in turn impacts the regional ecological restoration and sustainable management of water resources. In this study, soil water content data in depth of 0-5 m was obtained by long-term field observation and geostatistical method in 6 small watersheds covered with different land use pattern. Profile characteristics and spatial-temporal patterns of soil water were compared between different land use types, hillslopes, and watersheds. The results showed that: (1) Introduced vegetation consumed excessive amount of water when compared with native grassland and farmland, and induced temporally stable soil desiccation in depth of 0-5 m. The introduced vegetation decreased soil water content to levels lower than the reference value representing no human impact in all soil layers. (2) The analysis of differences in soil water at hillslope and watershed scales indicated that land use determined the spatial and temporal variability of soil water. Soil water at watershed scale increased with the increasing area of farmland, and decreased with increasing percentage of introduced vegetation. Land use structure determined the soil water condition and land use pattern determined the spatial-temporal variability of soil water at watershed scale. (3) Large-scale revegetation with introduced vegetation diminished the spatial heterogeneity of soil water at different scales. Land use pattern adjustment could be used to improve the water resources management and maintain the sustainability of vegetation restoration.