



Soil moisture variation in different vegetation types over multiple years in the semiarid Loess Plateau region

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Vegetation restoration, either by planting trees and shrubs or by conserving the degraded natural communities, has contributed greatly to the control of soil erosion in the Loess Plateau. However, soil desiccation has been reported as a potential land degradation issue following the planting of trees due to an imbalance of precipitation input against evapotranspiration. Here, we report a multiple-year measurement of soil water contents (SWC) within the 3-m depth in four land use types including an abandoned farm land and three typical vegetation types, i.e. black locust plantation, natural oak forest, and natural shrubs. Precipitation and vegetation types jointly determined the spatial characteristic of soil moisture with better soil moisture condition being observed in years with more rainfall. Precipitation significantly affected soil moisture in the shallow soil layer, whereas the deep soil moisture was greatly influenced by vegetation types. Temporal response of soil moisture to precipitation was largely dependent on time scale. At monthly scale, shallow soil moisture varied consistently with precipitation, and less fluctuation was observed below 1-m depth. At interannual scale, precipitation showed greater effects on deep soil moisture. Soil moisture depletion occurred after vegetation restoration, forests consumed more soil moisture than shrubs. Severe soil desiccation developed in deep layer under black locust plantation. A positive relationship exists between the variation of SWC and precipitation in growing season, and higher regression slopes were found in shrub and oak lands. The results suggest that the natural vegetation types have developed optimal water use strategies that adapt to both ample and relatively low precipitation, whereas the black locust plantations may cause an irreversible desiccation in deep soil.