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Soil water flow behavior of abandoned farmland restored with different vegetation communities in the Loess Plateau of China

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Natural vegetation succession in abandoned farmlands simulate the changes in near surface soil characteristics over the Loess Plateau of China, and hence likely induce temporal variation in the distribution and the movement of soil water in soil layers. In order to assess the effect of the natural vegetation succession on soil water flow behavior, four vegetation communities at different stages of succession (*Artemisia scoparia*, *Artemisia sacrorum*, *Bothriochloa ischaemum*, *Periploca sepium Bunge*) in Fangta watershed of Yan River were selected and dye tracer experiments were performed. Both the soil physicochemical properties (e.g., soil bulk density, the particle size, water stable aggregate (>0.25 mm) content, and soil organic matter) and the root systems (e.g., root mean diameter, root mass density, root surface area, and root volume density) tended to increase along with vegetation successional development. Results of the dye tracer experiment and the image analysis indicated that the preferential flow was the dominant type in the four field sites. Compared to the site in early stage of succession, the preferential flow proportion (FFP), preferential infiltration volume (PIV), and the contribution of the preferential infiltration to the total infiltration (Con) in the late stage enhanced by 6.65-7.34 times, 2.73-4.08 times, and 2.52-3.75 times, respectively. Correlation analysis suggested that the plant roots and their morphometric features played more important role on the preferential flow in comparison with the soil physicochemical properties. The abundant lateral root and the steeper slope may have caused the presence of lateral flow. Along with increasing degree of preferential flow, the spatial variability of the soil water through the vertical soil profiles increase during the process of restoration and succession of vegetation communities. Our study demonstrated the improvement of the preferential flow in the abandoned farmland during natural vegetation restoration helped soil water storage in the deep soil layer.