PAPER

Woody plant encroachment enhances soil infiltrability of a semiarid karst savanna

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Abstract

Semiarid karst landscapes are often the source areas for regionally important groundwater supplies. Like savannas across the globe, these landscapes are experiencing an increase in woody plant cover—often referred to as woody plant encroachment. Although this phenomenon is commonly viewed as leading to increased transpiration and reduced groundwater recharge, this may not be true of all ecosystems. For example, in the Edwards Plateau region of central Texas—where the underlying geology is karst—dramatic increases in baseflows have occurred concurrently with the expansion of woody plants. It has been suggested that in this context woody plants, especially juniper (*Juniperus spp.*), are partially responsible for boosting recharge by improving soil infiltrability, but this hypothesis has not been systematically evaluated. Our study examined the effects of an important encroaching shrub (Redberry juniper) on soil infiltrability in the Edwards Plateau. We carried out a large number of infiltration tests to determine soil infiltrability and used a dye tracer followed by soil profile excavation to estimate the potential for deep percolation. Tests were performed at increasing distances under juniper shrubs of five size classes, ranging from young seedlings to mature shrubs. We found that in soils underlying shrubs, infiltrability was quintupled and percolation depth almost tripled compared with soils in intercanopy zones. Surprisingly, shrub size was not a significant factor. Even the soils beneath the smallest shrubs had much higher infiltrability than intercanopy soils, showing that these woody plants modify soil properties at very early stages. We also found that both infiltrability and percolation depth gradually increased with proximity to the trunk and showed a strong correlation with litter thickness. Our results provide support for the hypothesis that in semiarid karst landscapes, woody plant encroachment—especially the invasion of juniper—can play an important role in enhancing groundwater recharge by improving the soil infiltrability.

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