Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

AGE03-04 会場:213 時間:4 月 30 日 11:00-11:25

...
Root Water Uptake and Soil Water Storage in a Karst Savanna on the Edwards Plateau, Texas, USA

徳本 家康 [1*]
TOKUMOTO, Ieyasu[1*]

[1]...
[1]Arid Land Research Center, Tottori University

Woody plants, especially Ashe juniper (Juniperus ashei) and honey mesquite (Prosopis glandulosa), are encroaching into a karst savanna on the Edwards Plateau in central Texas. However, their impact on hydrology is unclear because of high variability in soil depth and uncertainties about shallow and deep root contributions to water uptake in rocky soil overlying bedrock or other substrates that limit water storage capacity and root growth, and create high spatial variability in plant available water. This complex below-ground structure, while not uncommon, has of not been adequately characterized by most hydrological models. We evaluated root water uptake and water storage in the karst of the Edwards Plateau, at a typical savanna site with ˜50% woody cover, mainly Ashe juniper (Juniperus ashei) and honey mesquite (Prosopis glandulosa). Water content profiles to a depth of 1.6 m were measured by neutron thermalization and time domain reflectometry at 36 locations in a 25-by-25 m grid (5 m node spacing). Bulk density profiles were measured by gamma densitometry. Temporal changes in water storage were compared with eddy covariance measurements of evapotranspiration (ET) to evaluate relative amounts of ET originating from root water uptake at various depths. Water storage capacity in the measurement grid ranged from 185 to 401 mm, and coupled with heterogeneous distribution of trees created high spatial variability in root water uptake. Water uptake was higher beneath trees than beneath grass, in part because tree roots were able to extract water from regions of the root zone with high rock density. On average, 81% of the water uptake occurred from the upper 1 m of the profile with the greatest uptake occurring at depths of 0.4 to 0.8 m. An estimated 10% of the uptake occurred from below the maximum measurement depth of 1.6 m. While this result confirms the hypothesis that trees on rocky substrates take up water from greater depths compared to similar ecosystems on soil, it also refutes the view that trees in karst regions have greater access to groundwater.
Keywords: Root water uptake, Karst, Evapotranspiration, Spatial variability