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Monitoring Soil Moisture Dynamic in Root Zone System of Argania spinosa Using Electrical Resistivity Imaging

Authors : F. Ainlhout, S. Boutaleb, M. C. Diaz-Barradas, M. Zunzunegui

Abstract : Argania spinosa is an endemic tree of the southwest of Morocco, occupying 828,000 Ha, distributed mainly between Mediterranean vegetation and the desert. This tree can grow in extremely arid regions in Morocco, where annual rainfall ranges between 100-300 mm where no other tree species can live. It has been designated as a UNESCO Biosphere reserve since 1998. Argania tree is of great importance in human and animal feeding of rural population as well as for oil production, it is considered as a multi-usage tree. Admine forest located in the suburbs of Agadir city, 5 km inland, was selected to conduct this work. The aim of the study was to investigate the temporal variation in root-zone moisture dynamic in response to variation in climatic conditions and vegetation water uptake, using a geophysical technique called Electrical resistivity imaging (ERI). This technique discriminates resistive woody roots, dry and moisture soil. Time-dependent measurements (from April till July) of resistivity sections were performed along the surface transect (94 m Length) at 2 m fixed electrode spacing. Transect included eight Argan trees. The interactions between the tree and soil moisture were estimated by following the tree water status variations accompanying the soil moisture deficit. For that purpose we measured midday leaf water potential and relative water content during each sampling day, and for the eight trees. The first results showed that ERI can be used to accurately quantify the spatiotemporal distribution of root-zone moisture content and woody root. The section obtained shows three different layers: middle conductive one (moistured); a moderately resistive layer corresponding to relatively dry soil (calcareous formation with intercalation of marly strata) on top, this layer is interspersed by very resistant layer corresponding to woody roots. Below the conductive layer, we find the moderately resistive layer. We note that throughout the experiment, there was a continuous decrease in soil moisture at the different layers. With the ERI, we can clearly estimate the depth of the woody roots, which does not exceed 4 meters. In previous work on the same species, analyzing the δ18O in water of xylem and in the range of possible water sources, we argued that rain is the main water source in winter and spring, but not in summer, trees are not exploiting deep water from the aquifer as the popular assessment, instead of this they are using soil water at few meter depth. The results of the present work confirm the idea that the roots of Argania spinosa are not growing very deep.

Keywords : Argania spinosa, electrical resistivity imaging, root system, soil moisture
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