Geophysical Research Abstracts, Vol. 9, 07163, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-07163


# Degree of water repellency and its relation to surface runoff, infiltration and finger flow, in afforested sand dunes.

Y. Arbel

Department of Geography and Environmental Studies, Haifa University, Israel.

yarbel@geo.haifa.ac.il

Soil water repellency (WR), frequently found in sandy soils reduces infiltration rate and can generate runoff. On the other hand, WR may also lead to deeper infiltration in preferential flow paths. This paper demonstrates a model for classification of water repellency degree based on correlation between WR indicators and its hydrological response in the plot scale. This classification results from research on the effect of Organic Hydrophobic Sandy Layer (OHSL) underneath *Tamarix aphilla* litter, on the hydrology of afforested sand dune in arid area.

The hydrophobic character of the organic layer was examined in two different tests: Water Drops Penetration Time (WDPT) – indicating the *persistence of WR*), and the Critical Surface Tension (CST), which relates to the contact angel ($\gamma$), and indicating the initial *Intensity of WR*. Rain - runoff ratio examined in 8 runoff plots (5 and $15m^2$)on surface of increasing litter cover (and the resultant water repellency), and with sprinkling experiments at different rain intensities. Infiltration depth and patterns were determined in the moisture profiles after the experiments, and through infiltration tests with color tracer solution.

New water repellency categorization supported by compatible clustering of both methods (CST and WDPT) into 4 levels. Those categories resulted in better concurrence with the development of runoff and finger flow. The threshold for development of stable runoff and/or persistent fingers flow is above 120sec WDPT and below 54 dyne/$cm^2$ CST (named “Strong WR”). Exponential regression between CST and WDPT demonstrate the accelerated increase in *Persistence of WR* with smaller val-

ues of CST (increases in initial WR). In the maximum range of initial water repellency (50-53 dyne/cm$^2$) WDPT changed from 300sec to more than 10min. From this state of CST other factors like granalometric composition or variation in the Organic-hydrophobic matter, are more important in creating higher *Persistence of WR.*.

The minimal rain intensity for obtaining runoff on runoff plots with Strong water repellency is 15 mm per hour. On slope dunes, which have sparse litter and no organic layer, no notable runoff developed. WDPT had better correlation to runoff then CST ($R^2$= 86% and 63% respectively). Runoff coefficients on Strong WR were up to 55% of the water-volume applied at an intensity of 30 mm per hour on sprinkling experiments, but were much smaller (up to 8% runoff per storm) in the 5m$^2$plots, and decreased in the larger runoff plot.

The runoff concentrated water into depressions, where it infiltrates in finger flow paths under the organic layer; there water is better preserved from evaporation. So, the final effect of the organic hydrophobic sandy layer is to increase soil water content in the sand dune, and to increase the amount of water available for the trees.