VANDERBILT
School *of* Engineering

DEPARTMENT OF CIVIL & ENVIRONMENTAL ENGINEERING

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**FGH 110**

# "REMEDIATION & HYDROLOGICAL IMPLICATIONS OF OIL-INDUCED SOIL HYDROPHOBICITY IN THE EVRONA NATURE RESERVE"

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**ABSTRACT**

Soil hydrophobicity was extensively investigated in the context of fire-induced, naturally-occurring and wastewater related hydrophobicity. However, Oil-induced soil hydrophobicity received less attention. In this study, we investigate the hydrological effects and the persistence of oil-induced soil hydrophobicity in the hyper arid Evrona Nature Reserve. The reserve has experienced two oil spills that occurred in 1975 and 2014. In this study, we 1) characterize the hydrophobicity and the soil related properties in the polluted soils 2) apply field monitoring to investigate how hydrophobicity affects water flow in the polluted soils, and 3) conduct laboratory incubation experiments to assess the natural attenuation of hydrophobicity and its relation with the content and composition of hydrocarbons.

We set up two monitoring stations in two adjacent streams, of which one is polluted and the other is clean. In each stream, an array of water content sensors was installed. Analyses of the data reveal that during rain events infiltration in the oil-contaminated soil was much lower relative to the clean soil and showed highly preferential patterns. This may lead to negative consequences such as increased runoff and erosion, and reduction in the water available to native plants.

In the second part of the research, incubation experiments were conducted. Contaminated soils were treated with the addition of either water alone or combinations of water, nutrients and surfactants. Treated soils were sampled periodically to assess soil hydrophobicity and hydrocarbon content. The results show a concomitant decrease in the hydrophobicity and hydrocarbon content in the treated soils. Overall, the total petroleum hydrocarbon of the treated soils decreased by 40% in the 2014 soil and by up to 80% in the 1975 soil. However, the soils remained severely hydrophobic. This suggests that considering the concentration of hydrocarbons as the sole criterion for the endpoint of soil remediation is not sufficient and the degree of soil hydrophobicity should be evaluated as well.

**BIOGRAPHY**

**Dr Ravid Rosenzweig** is a staff scientist at the Water Resources Division, the Geological Survey of Israel and an adjunct faculty at the Department of Earth and Environmental Sciences, Ben Gurion University of the Negev. Her research revolves around flow and transport in porous media. Specific research areas include modeling CO2 storage in deep geological formations, radioactive waste disposal, pollutants transport in unsaturated environments, and interaction between subsurface flow and biological activity.