

Final Report: Desert Soil Characterization for Detection of Buried Landmines, Unexploded Ordnance, and Tunnels

The goal was to thoroughly describe the physical landscape properties that affect desert soils so that improvised explosive devices (IEDs) can be detected with greater accuracy. This project was conducted to better understand the impacts of soil properties on IED sensor effectiveness and to enhance performance of IED sensor technologies such as thermal imaging and ground penetrating radar. The effectiveness of these improved technologies is dependent on soil properties along with the IED emplacement. We conducted this project at YPG, AZ where well-characterized, monitored sites presented an opportunity to gather data to meet the the project objectives. Results were reported in 2010. Our results showed that soil composition and salt content clearly influence ground penetrating radar (GPR) profiles.

Summary of Project Details: We established three master environmental reference sites (MERS), two at YPG and one in Reno, NV. The site locations represented analog conditions to Iraq and Afghanistan. We deployed remote and automated monitoring systems at select testing sites. We collected data on conductivity, capacity and heat flux, on dielectric permittivity and electrical conductivity, and on water content and temperature. We took field measurements using spectroscopy, GPR and electromagnetic induction. These measurements were used to evaluate how the desert soil impacts these latter sensor technologies.

Management Implications:

The two primary sites at YPG at the Joint Experimental Research Complex (JERC) had different soils, one highly saline and one that was much less saline. We found that soil salinity is a key factor that affects properties important for IED detection, such as thermal diffusivity and conductivity, among others. We found that the soil surface can affect the subsurface, such as the presence of desert pavement as found at JERC. Desert pavements affect overall energy flux, which varies with the age of the pavement.

