

Restoration of degraded arid farmland at Project Wadi Attir: Impact of conservation on biological productivity and soil organic matter

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The Israeli Negev Desert, as most Mediterranean drylands, is profoundly degraded. We have been documenting degradation and successful rehabilitation approaches in recent research, aiming at maximizing environmental and economic benefits while restoring healthy dryland soils and perennial vegetation to act as carbon sinks. These methods have been implemented for rehabilitation of Project Wadi Attir's. 50 hectares of heavily degraded farmland suffering from intensive soil erosion (expressed in dense gullies net and massive overland flow). Project Wadi Attir is a groundbreaking initiative of the Bedouin community in the Negev, for establishing a model sustainable agricultural operation. The project was initiated by the US-based Sustainability Laboratory and the Hura Municipal Council. The project is designed to demonstrate implementation of holistic sustainability principles developed by The Lab. The project's ecosystem restoration component involves site development, erosion control, soil conservation and improvement, planting of native and agroforestry trees, together with conservation and protection of biodiversity hotspots and avoiding grazing have, within three years, revealed the high biodiversity and productivity potential of this arid/semi-arid landscape. A number of shrublands and loess plots were subject to strict conservation, avoiding tilling and grazing. Soil fertility, productivity and biodiversity of these conserved plots inside the farm boundaries was compared to similar unprotected plots outside the farm fences by sampling in the field and by using satellite imaging. Our findings indicate a gradual improvement of SOM content specifically in the conserved shrubland area. Water infiltration, herbaceous biomass productivity and ants' activity of the protected plots also significantly increased within 3 years compared to the unprotected control areas. Starting from similar soil organic matter content in 2013 (3.3%) in the rocky slopes, in 2016 1% higher SOM was measured inside the farm vs. outside (4.5% compared to 3.5%, respectively). In spring 2014 herbaceous biomass production was similar in both areas (0.05 Kg per m²), while in spring 2016 0.25 Kg per m² were measured in the pedestal inside the farm compared to 0.06 Kg per m² outside were observed. Consistent but less dramatic, changes were observed in the loess areas inside the farm with a productivity difference of 1.1 inside compared to 0.19 Kg per m² outside in 2016 as compared to 0.05 Kg per m² observed in both areas in 2013. Our results indicate that soil conservation together with proper land management and protection of biodiversity hotspots will enable sustainable agricultural management in degraded drylands all over the globe under significant gains in productivity, biodiversity and carbon sequestration.