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Ecosystem restoration at the Arid-Semiarid Interface in Israel's Northern Negev

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The interface between the arid and semi-arid zones in Southern Israel (as elsewhere in the world) is heavily degraded. Thousands of years of overexploitation by wood cutting, farming and grazing have left the area at 10 – 30% of their nominal biological productivity, void of any trees and shrubs, and generally low in biodiversity. Degradation is an ongoing process in Israel's open areas, whereby overgrazing and continuous soil tilling for field crops, and contour trenching for planting of exotic tree species are the main drivers for ongoing soil degradation. The results of those activities are further loss of productivity, soil organic matter and soil nutrients, and massive soil erosion. In the framework of several research projects and a large ecosystem restoration project (http://www.sustainabilitylabs.org/ecosystem-restoration/) we have analyzed in detail the drivers of degradation by field studies accompanied by GIS analyses.

Various approaches for soil restoration have been attempted and documented. Fencing of and protection from grazing has a rapid impact on the amount of standing biomass left both in rocky slopes, and degraded loess plains, leading to increased plant biodiversity, and initiating rapid growth in harvester ant activity. This ant activity seems to provide an important positive feedback on enhancing soil fertility and biological productivity, and we postulate a recovery mechanisms whereby enhanced food availability to ants and similar soil dwelling herbivores enhances soil nutrient pools, soil organic matter, soil aeration and soil water infiltration to result in a cycle of ongoing productivity improvements and ecosystem recovery.

Alternative, faster and more expensive methods of restoration tested are overlaying of degraded soils using compost or manure, a method immediately restoring 5 – 10 fold higher biological productivity, which was being maintained for at least 10 years and appears permanent unless renewed degradation should occur.

We have widely reported on the benefits of using of Acacia victoriae for rapid restoration of degraded Negev drylands. Planting of hundreds of A. victoriae seedlings three years ago is now providing first insights into its benefits. Seedlings managed to survive even without irrigation (at 200 mm mean annual precipitation). Placed inside rills, the trees develop exceptionally well reducing soil erosion and gully formation. Shedding of leaves created litter patches that already now enhance germination of annual weeds, inducing a cycle of ongoing soil improvement.

In conclusion, we present here a portfolio of successful ecosystem restoration options for degraded drylands promising dramatic gains in biological productivity and biodiversity, essential for addressing concerns of future land, food and water scarcities. In addition, confirmed sequestration rates of 3 – 5 tons of carbon dioxide into soil and biomass can be achieved in those areas, highly relevant in the framework of the recently agreed upon climate agreement.