Geophysical Research Abstracts,
Vol. 11, EGU2009-13514, 2009
EGU General Assembly 2009

Trends in soil-vegetation dynamics in burned Mediterranean pine forests: the effects of soil properties

L. Wittenberg and D. Malkinson
University of Haifa, Geography and Environmental Studies, Israel (leaw@geo.haifa.ac.il)

Fire can impact a variety of soil physical and chemical properties. These changes may result, given the fire severity and the local conditions, in decreased infiltration and increased runoff and erosion rates. Most of these changes are caused by complex interactions among eco-geomorphic processes which affect, in turn, the rehabilitation dynamics of the soil and the regeneration of the burnt vegetation.
Following wildfire events in two forests growing on different soil types, we investigated runoff, erosion, nutrient export (specifically nitrogen and phosphorous) and vegetation recovery dynamics.
The Biriya forest site, burned during the 2006 summer, is composed of two dominant lithological types: soft chalk and marl which are relatively impermeable. The rocks are usually overlain by relatively thick, up of to 80 cm, grayish-white Rendzina soil, which contains large amounts of dissolved carbonate. These carbonates serve as a limiting factor for vegetation growth. The planted forest in Biriya is comprised of monospecific stands of Pinus spp. and Cupressus spp. The Mt. Carmel area, which was last burned in the 2005 spring, represents a system of varied Mediterranean landscapes, differentiated by lithology, soils and vegetation. Lithology is mainly composed of limestone, dolomite, and chalk. The dominant soil is Brown Rendzina whilst in some locations Grey Rendzina and Terra Rossa can be found. The local vegetation is composed mainly of a complex of pine (Pinus halepensis), oak (Quercus calliprinos), Pistacia lentiscus and associations
At each site several 3X3 m monitoring plots were established to collect runoff and sediment. In-plot vegetation changes were monitored by a sequence of aerial photographs captured using a 6 m pole-mounted camera.
At the terra-rosa sites (Mt. Carmel) mean runoff coefficients were 2.18% during the first year after the fire and 1.6% in the second. Mean erosion rates also decreased, from 42 gr/m2 to 4 gr/m2. The recovering vegetation was dominated by shrub and resprouting trees, and vegetation cover values of 31.5% and 24% were found in the north and the south facing slopes, respectively. In the second study year vegetation cover reached 65% and 54%.
In spite of similar precipitation distributions, different patterns were observed at the light rendzina sites of Biriya where both runoff and erosion rates remained high along the two-years study period. Mean runoff coefficients exceeded 10% on both slopes, during the first year and only a slight decrease was noted during the second one; erosion rates increased from 120 gr/m2 to 180 gr/m2. After the first rainy season only 5.7% of the plots were covered by herbaceous vegetation on both slopes. At the beginning of the second season vegetation cover remained low, and towards the end of it mean cover increased to 38.7% / 52% on the north and the facing slopes.
Total P and total N were measured in the runoff water collected in the Biriya sampling plots. Results indicated that nutrient losses are well correlated with TSS concentrations. During the first season TP values (in runoff water) ranged from 2.2 – 142 mg/l, while TN concentration ranged from 2.5 – 2595 mg/l. During a high intensity rainstorm, TSS in the Biriya site exceeded a value of 1000 g/m2.
Lower rates of revegetation as observed in the Biriya sites, and the consequent high runoff and sediment coefficients, and can be associated with several factors. Among them are the maturity of the planted pine forest and the fire-induced destruction seed bank, but also to local soil characteristics. Amplified runoff rates associated with high TSS, and N and P losses, might further contribute to the relatively slow revegetation rates and to the consequent delayed decrease in runoff and erosion.