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Water balances of small plots in a forest planted in an arid zone

P.R. Berliner and T. Merzer

Wyler Department of Dryland Agriculture, Blaustein Institute of Desert Research, Ben Gurion University of the Negev, Israel. (Berliner@bgu.ac.il / Fax +972-8-6596757 / Phone +972-8-6596755)

In the eastern Mediterranean rainfall distribution is unimodal and showers with high rainfall intensity d occur during autumn and spring. In autumn the soil surface of pasture-only catchments is quasi-bare due to grazing in the preceding spring and summer, and the high intensity rainfalls lead to the generation of runoff and the concomitant soil losses due to erosion. The presence of trees with developed canopies decreases the production of runoff as evidenced by the lack of flow in the ephemeral rivers that emerge from forested catchments. However, changes in plant cover may affect the hydrological balance. The presence of tree canopies decreases runoff generation by reducing the energy of the drops that hit the surface and could therefore potentially lead to an increase of the input of water into the soil. On the other hand, part of the intercepted rainfall may evaporate before reaching the soil, and trees could use a larger fraction of the water stored in the soil than annual herbs do. The latter two processes could offset the previously mentioned gain and thus negatively affect the water balance.

The present study, whose aim was to determine the effect different types of vegetative cover have on the water balance of small plots, was carried out in a forty-year old forest planted in the Yatir area (average annual precipitation 270 mm and annual evaporation from class A pan 2000 mm).

The effect four different cover types (bare soil, annual herbs, trees and trees with an annual herb understory) have on water balance of small plots within the Yatir forest was studied.

Plots (three replicates per treatment, area of 30m^2 with a slope of 1-3%) with the dif-

ferent vegetation covers were established in the forest and within a nearby clearing. In each of the plots within the forest, five self-made totalizing rain gauges were installed along the diagonal of the plot. In the open area, additional totalizing gauges were installed as a reference, allowing the assessment of rain interception by the trees. Atop a meteorological tower located close by and within the forest, a recording tipping bucket type rain gauge was installed in order to measure total rainfall depth and intensity throughout the event. The sensitivity of the device is 0.25 mm.

At the lowest point of each plot, the generated runoff was collected and measured using specially built tipping buckets with a sensitivity of 0.133 mm (runoff) s^{-1}connected to a single event data logger. Soil moisture was monitored using a neutron probe. At least one access tube to a depth of 4 m was installed in each plot.

Rainfall and runoff were monitored during rainfall events and soil water content and above ground dry biomass were routinely monitored during two years. The results indicate that the annual herbaceous vegetation cover plays a major role in reducing runoff in the absence of trees, particularly at the onset of the rainy season. The presence of trees was as efficient as that of the annual herbaceous cover in reducing runoff. Maximum influx of water into the soil was registered for those treatments for which the lowest runoff was recorded. No changes in the soil water content were registered at depths greater than 1.5 m . At summer's end no significant differences could be found in the total soil water content of the various treatments.