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Species specific vs individual differences in throughfall and stemflow patterns in a semiarid cloud forest

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Forest canopies substantially modify the precipitation input arriving at the soil surface. The canopy provides an obstacle, leading to storage and subsequent loss of arriving rainwater to evaporation (interception loss), but occasionally also to gain of water by capturing surface clouds (horizontal precipitation). In either case, the water flow arriving below the canopy is characterized by considerable spatial heterogeneity. Strong variation and time stability in the resulting spatial fields might induce persistent small scale patterns in infiltration, soil moisture, and nutrient availability.

Here we present the results of an experiment we conducted within a re-forested area in the semiarid cloud forests within the Dhofar Mountains (Oman). We observed individual stemflow and community throughfall in plots covered with two different tree species (Pithicellobium dulce and Leucenia leucacephala) over a two year period. Additionally, we measured small scale (0.5m spacing) variability of throughfall within a small (14m x 14 m) plot over two weeks.

The community fluxes of throughfall varied little between plots of the same or different species. Community stemflow was similar in plots covered with the same species, but in contrast it varied considerably between plots of different species. While stemflow of Pithicellobium contributed about 20% to net precipitation, in Leucenia it contributed 40%, probably because of favourable tree architecture. Since stemflow is a point source of water to the ground, infiltration rates near the stems are considerably higher (up to 60 mm/d) than in the surrounding area (up to 11 mm/d). Therefore, individual stemflow yields might contribute to maintaining spatial patterns of heterogenous infiltration. Comparison of time stability of stemflow and throughfall show that the spatial pattern for both are reasonably stable in time, in that above (or below) average fluxes occur at the same spots during most of the observed events. However, differences between individuals are not as pronounced as between species.

Our results indicate that the main driver of spatial heterogeneity of net precipitation in this cloud forest is stemflow. Furthermore, the stemflow pattern is more strongly affected by species than individual.