



Variation in rainfall interception along a forest succession gradient

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Rainfall interception by forest canopies reduces the water influx to the forest floor. When forests are replaced by pasture, the process of canopy interception temporarily stops until a new forest develops on abandoned pasture land. Modern land-cover change typically involves regrowing forests but the relation between forest succession and canopy interception is hardly understood. This lack of knowledge is unfortunate because rainfall interception plays an important role in regional water cycles and needs to be quantified for modeling purposes. To help close the knowledge gap, we designed a chronosequence study of throughfall along a secondary succession gradient in a tropical forest region of Panama. The investigated gradient comprises 20 natural forest patches regrowing for 1 up to about 130 years. We sampled each patch with a minimum of 20 funnel-type throughfall collectors over a continuous two-month period that had nearly 900 mm of rain. At the same time and locations, we acquired forest structure data based on DBH measurements of all trees > 1 cm DBH, identified all tree species, and took hemispherical photographs to calculate canopy openness. We used Bayesian Model Averaging (BMA) to identify those vegetation parameters that have the strongest influence on interception variation. Interception loss increased with forest age from 0 to nearly 200 mm of the total rainfall input (0 – 20 %), with the steepest rise occurring within the first decade of forest succession. Parsimonious models which contain canopy openness and basal area or stem density of stems smaller than 5 cm DBH are favored about more complex models. Leave-one-out cross validation revealed that our BMA approach can be used to predict interception with an RMSE of 5 %. Based on our results we argue that hydrological modeling exercises should account for variation in interception due to succession stage, which is possible e.g. by using a statistical approach to relate interception estimates to forest structure.