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Hydrology and Earth System Sciences Discussions

Interactive comment on "Hydrologic feasibility of artificial forestation in the semi-arid Loess Plateau of China" *by* T. T. Jin et al.

Anonymous Referee #2

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The paper deals with an empirical approach to evaluate the relationship between Soil Moisture Content (SMC) and environmental variables that include rainfall (at a regional scale), stand age, canopy density, stand density, herbaceous cover, topography, organic matter, etc. The work is based on measurements undertaken in 12 sites located in three catchments of the Loess Plateau of China in the Northern Shaanxi Province. The authors selected the sites based on different amount of annual rainfall and considered only one type of forest cover (Robinia pseudoacacia) that is typical of that area. The overall results suggest that at a regional scale the SMC spatial variability was most closely correlated to rainfall. At a local scale, the stand age seemed to play a key role in regulating the amount of water retained into the soil even if its effect is strongly dependent on the amount of rainfall. Significant correlation was found between SMC and latitude, and SMC and tree and canopy density. Only for catchment 1 the correlation

between SMC and organic matter was good.

In general, there is a scientific value of the manuscript even if it is difficult to check the consistency of the results with what found in previous contributions because some of the papers published by the authors are in Chinese and no rough data are provided by the authors in this paper. However, I think the authors are correct in considering the relationship between forest and water crucial for the success of artificial forestation and that the construction of artificial plantations needs to be evaluated based on the climate conditions (especially rainfall and soil moisture).

I found interesting the approach used here to investigate the SMC content by considering the spatial variation of ground- and canopy cover and also the stand age. However, as the authors recognised, soil moisture is a product of different factors that include not just the rainfall amount but also type of vegetation and soil. The latter plays a key role in water budget and, as I see it, relationships between soil properties and SMC must be explored further. For example, in Fig. 2b the authors recognise the presence of two layers of SMC values. They try to explain this considering that an insufficient profile water supplementation is responsible for the appearance of a turning point. What about texture? The authors say that the soil texture in the Loess Plateau is derived from parent materials and has not changed significantly for a century. I am not familiar with that area but looking at the paper of Li and Shao (2006), it is clear that (apparently in a very similar area) both bulk density and porosity depend on soil depth (see table 2 of their paper). In other words, even if the analysis of Li and Shao is based only on two soil layers (0-20 and 20-40 cm), for the same type of vegetation there is a decreasing trend of porosity (increasing obviously for bulk density) with depth. This means that the turning point of Fig. 2b can be strongly related with soil properties. In fact, as Li and Shao pointed out, change of soil bulk density and porosity may affect soil water-holding capacity and consequently soil water conditions for different vegetation succession stages. Do the authors have evidence of it? Can they plot texture properties vs soil depth for the soils sampled in their catchments? The same findings come

from the measurements undertaken by Li and Shao (2006) about hydraulic conductivity (Ks) for the surface layer 0–20 cm and the subsurface layer 20–40 cm. In other words, Ks decreases with depth in the first 40 cm and this would justify the higher amount of SMC found by the authors in the deeper layer. Do authors have measurements of Ks for their soils in order to support their assumptions?

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 8, 653, 2011.