

Interactive comment on “Can the Pinus sylvestris var. mongolica sand-fixing forest develop sustainably in a semi-arid region?” by Yiben Cheng et al.

Anonymous Referee #2

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Sustainable soil remediation is an important and urgent topic, as it is presently still unclear how effective some remediation strategies are. The authors address the use of *Pinus sylvestris* var. *mongolica* as a way to fixate sand in the Mu Us Sandy land in Northwestern China, specifically, if rain-fed forestry can sustainably develop in the region. Their study describes the use of a newly developed deep soil recharge lysimeter to monitor a 30-year old pine artificial forest. The current presentation of the methodology lacks sufficient detail (see specific comments below), and the results present only parts of the water balance on which the conclusions are then based. This results in a paper that is currently difficult to evaluate. Also, there is no discussion section present. Specific comments: Line 16: in this semi-arid region Line 18: “as an example” In the

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introduction I read in line 90-99 that many of the reforestation efforts are unsuccessful and *Pinus sylvestris* var. *mongolica* (Psvm) is the most common specie used in 3NSP. There is no statement on whether this species is more resilient, or why the abstract mention this as being an example. Can these several statements be more connected to clarify the actual success of using Psvm? Line 29-30: Reported results are for period 2016-2018, and it is concluded deep soil recharge happened and thus Psvm can sustainably develop. I think this conclusion is not merited on a 3 year observation period. There is nothing reported on the state of the 30 year old Psvm forest, are these trees normally developed or not? Were they irrigated during that time? What is the minimum amount of water needed for these trees to survive? Also I have my doubts at the significance of the reported digits of the water balance. See later comments. Line 37: In the abstract the term desertification was used in the context of an arid environment. Here it is used in a broader sense. The World Atlas of Desertification (2018) has revised the definition due to confusion outside the context of (semi-)arid areas and now promotes the use of the term land degradation instead of desertification. Whether the authors use desertification or land degradation I suggest to refer to a formal definition in this particular general context. Line 101: “sustainable” This question is not very specific. Sustainable in term of what exactly? Line 128-129: Unclear if this refers to general observations from literature or from the inspected field site. Please explain. Line 135-137: “measurements were made without interference of canopy in the middle between forest lines” So, no root water uptake was measured, no intercepted precipitation or interecepted evaporation? The assumption being that the amount of deep recharge will be the amount available to the trees to take up water? But in that case you are missing the interception term, and the amount of water infiltration in the forest will be less than what is measurement in the DSR setup, which then invalidates your conclusions. Please explain more clearly so the reader can follow. Line 139-143: What was the soil composition/classification? Which soil moisture sensors were used? The miniTrase refers to the cable tester, not to the particular type of moisture sensor. Was a factory calibration used with the soil moisture sensors, and which one? Line 146: “sur-

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face runoff does not exist” Was this not observed, even in snowmelt conditions? What was the slope in the area? Please specify. Line 152-154: “point A and B” not indicated in Fig. 2 Fig 2: Does not include an arrow for evaporation? Is it not measured? Fig 3: The caption states the figure shows annual precipitation as well, but only the soil moisture readings are reported. As soil moisture changes in the lysimeter are a result of precipitation and soil evaporation (assuming no trees were growing in the lysimeter), so please include precipitation over 2016-2018 in the results section. Also in the frozen season the soil moisture sensors readings drop. As freezing impacts the dielectric permittivity the sensor readings can be impacted. See for example: Hallikainen, M. T., Ulaby, F. T., Dobson, M. C., El-Rayes, M. A., & Wu, L. K. (1985). Microwave dielectric behavior of wet soil-part 1: Empirical models and experimental observations. *IEEE Transactions on Geoscience and Remote Sensing*, (1), 25-34. Nothing is mentioned in the text, regarding these readings. Line 186: Please explain how I can assess this from Fig 3? I see more than four increases in soil moisture at the 200 cm depth. Do the authors mean there are four time when water was collected in the measurement section of the DSR? Fig 4: Changes are reported in increments of <0.01%. What was the accuracy of the soil moisture sensors, and are the data in Fig 4 not impacted by this? Or is the scale perhaps not what I think I am seeing, fraction instead of percentage? Line 201: “annual soil moisture infiltration” Please explain how these reported numbers were obtained in the methodology, I suspect the infiltration is either weighed or measured otherwise, but it is not described at present. Table 2: If the accuracy of the precipitation measurement is 0.2 mm, the calculated ET cannot have more reported significant digits. Please adjust. Also if as stated the measurements were made in the middle between the forest line, what then caused the transpiration term in the ET? Or was the DSR placed underneath the canopy, while precipitation and soil moisture were measured outside of the canopy. For me as a reader it became a bit vague at this point. In this water balance the canopy interception is not considered as well, making the concluding statements doubtful. Line 213: And this would not depend on posterior soil moisture conditions as well? Line 318&324: Please adjust the reported significant

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digits.

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