



EGUsphere, referee comment RC1
<https://doi.org/10.5194/egusphere-2022-317-RC1>, 2022
© Author(s) 2022. This work is distributed under
the Creative Commons Attribution 4.0 License.

Comment on egusphere-2022-317

Anonymous Referee #1

Referee comment on "Reconciling different approaches to quantifying land surface temperature impacts of afforestation using satellite observations" by Huanhuan Wang et al., EGU sphere, <https://doi.org/10.5194/egusphere-2022-317-RC1>, 2022

The manuscript "Reconciling different approaches to quantifying land surface temperature impacts of afforestation using satellite observations" by Wang et al presented thoughtful analyses regarding three different types of temperature effects of forestation that appeared in the literature (potential vs actual), and trying to explain the causes of the different magnitudes. The research is a nice addition to the literature on this topic as it is helpful to clarify the interpretation of different results.

Major comments:

First, I disagree with the authors' interpretation of these results and the claim that the causes of the different estimates are unknown. On the contrary, spatial scale or fractions of forest change matters for interpreting the temperature impact, which has been considered in previous studies. Taking the influential work cited by the authors as an example:

In Alkama 2016, the fraction of forest cover change is explicitly taken into account, and the results clearly indicated that the temperature effect depended on the fraction of change.

In Li 2016, the fractional dependency has been reported: "It should be noted that the estimated impacts also depend on the thresholds used to define forest cover change, as discussed in section 2.2. The sensitivity analysis shows that a higher threshold to define forest change leads to stronger impacts on temperature."

In Duveiller 2018, they used the temperature effect of 100% conversion to avoid the influence of fractional changes.

The strength of this work is that it explicitly addressed this question. Perhaps the authors could consider an alternative title better reflecting this point.

Second, the main finding is that the fraction of forestation (complete vs incomplete) explains the different magnitude of temperature effects. Fraction could indeed have a strong influence on the temperature signal. But it is not the only one. Other factors such as the timing of land cover change, length of the study period, and the spatial extent of forest cover change impact may also contribute. (1) Taking the timing of de-/forestation as an example, if the change happened in the different years of the two periods of 2002–2004 (t1) and 2010–2014 (t2) (L277), changes in 2002 and 2010 would produce a larger temperature change compared to changes in 2004 and 2014, depending on whether the change signals lasted full three years or just the last year. (2) More importantly, the space-for-time assumption is acceptable but it is not strictly true in reality. The adjacent two sites did not share the same climate condition (see Chen 2016). This also contributes to the different temperature effects. (3) When the spatial extent of forest change is large, the local and nonlocal temperature effect appear with heterogeneity which confounds the estimation of the local temperature. (4) The consistency between the actual and potential effect is also scale-dependent. At small scales (e.g., 10m resolution), it would be easier to achieve full change compared to large scales (1km). Therefore, the differences in fractional change alone cannot fully reconcile the observed differences.

Third, I feel the language of this manuscript should be improved and polished.

Specific comments:

L102-103 They may not assume 100% complete ground coverage. They used the defined forest and nonforest in the paper. Of course, due to inherent scaling and the mixed pixel issue in remote sensing, the defined pixels cannot be 100% pure at a given scale. I think many studies were aware of this issue but they did not explicitly address it.

L161-162: How are the afforestation and adjacent control pixels defined?

L518: What do you mean "extensive variable"?

L549 to 551: For this fractional dependency, it has been reported in such as Li 2016

L572-573: The actual and potential effect is also scale-dependent, and so is the feasibility of full afforestation in reality. Fully afforested could be easily achieved for a small pixel 30m. And for this pixel, the potential and actual could be similar following the findings of this work. At larger scales, it is more difficult to become "fully" afforested, which leads to larger differences between potential and actual impacts. Therefore, whether "achieving the full cooling potential" is scale-dependent.

L581-583: I disagree with the authors on this. The potential effect is useful as it measures the possible outcome of full conversion or mostly afforested (depending on resolution and scale), and whether it is realized depends on the fraction of the change. One can take into account the fractional change to convert the potential effect to more reasonable estimation. At least for this reason, it is not misleading. It is about different interpretation and clarification is needed.

L602 to 605: I don't agree this statement because both the actual and potential effects are scale dependent. Without mentioning the scale, it is incorrect.

References

Alkama, R., & Cescatti, A. (2016). Biophysical climate impacts of recent changes in global forest cover. *Science*, *351*(6273), 600–604. <https://doi.org/10.1126/science.aac8083>

Chen, L., & Dirmeyer, P. A. (2016). Adapting observationally based metrics of biogeophysical feedbacks from land cover/land use change to climate modeling. *Environmental Research Letters*, *11*(3), 034002. <https://doi.org/10.1088/1748-9326/11/3/034002>

Duveiller, G., Hooker, J., & Cescatti, A. (2018). The mark of vegetation change on Earth's surface energy balance. *Nature Communications*, *9*(2018). <https://doi.org/10.1038/s41467-017-02810>

Li, Y., Zhao, M., Mildrexler, D. J., Motesharrei, S., Mu, Q., Kalnay, E., ... Wang, K. (2016). Potential and Actual impacts of deforestation and afforestation on land surface temperature. *Journal of Geophysical Research: Atmospheres*, *121*(24), 14372–14386. <https://doi.org/10.1002/2016JD024969>