Review Response: Trees in many US cities may indirectly increase atmospheric carbon

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Summary of Changes

- 3's comments about big picture. My stance should be more collaborative. highlight the complementary nature of my work to the modeling approaches.
- I need to show that many papers

Response to Reviewer Comments

Referee: 1

Review report ERC-100072.pdf

Comments:

1. The results of yours are so strongly dependent on the number of heating and cooling degree days and the fuels/technologies utilized for electricity and heat production, that it does not make sense presenting the results without this information presented first.

(a) I mention this in the 4th paragraph on page 3, lines 44-45. I will add emphasis to this point at the start of the discussion section.

2. You should not satisfy with your case results, but look at the conditions in which the balance is turned other way round (referring to the first comment).

   (a) This is what I attempted to do by updating Akbari and Konopacki 2005 model. I think that a proper analysis that could accurately identify the thresholds in climate and other important factors where the effect of trees is reversed is beyond the scope of this paper. My aim was to present our case results and

1. You should discuss the distance issue in the introduction. Now you are sort of partially discussing all urban trees, but then continuously referring to "shade trees". You also refer to energy need reduction as the primary gain from tree planting programs, which points at these shade trees rather than all urban trees.

   (a) I will add text in the 3rd paragraph to this effect.

2. You go deep into the previous studies in the introduction. I suggest splitting up the section to a shorter and simpler introduction and previous literature gap analysis.

   (a) Good idea. Thanks.

3. Don't limit your generalizability discussion to just the U.S.

   (a) Thanks for the suggestion. I'll change "cool climate communities in the US" to "cool climate communities". For the part of my work that builds on Akbari and Konopacki 2005, I will keep the US centric view.

4. I wonder why you don't mention building types at all in the introduction. It is not uniform how the shading effect works with buildings of different types, and presumably in cool climates the buildings are on average better insulated.

5. Extend the study description from the current one short sentence on lines 107-108. Even if the paper follows the style guideline placing the methods and data descriptions to the end, you must briefly tell to the reader what was done.

6. Please explain better how only north side cover can lead to an increase in the need for warming. Shouldn't tree coverage lead to lower heat loss through the north wall?

7. Extend the C storage comparison section with the actual outcome numbers and meaning.

8. In the "considering the larger C cycle", I would find it appropriate to notice that hundreds of years of storage can be very important in mitigating climate change now and allowing for energy system transition to take place.

9. You are making several assumptions yourselves, but don't discuss much this aspect of your study (you point out some weak assumptions in previous studies).

Referee: 2

COMMENTS TO THE AUTHOR(S)

- The paper summarizes the results of a statistical analysis.
- No data or results are shown and the reader has to rely on the authors for their conclusions.
- The physics of the claim that trees increase CO2 emission is not explained and modeled.
- One cannot understand the basis of the conclusions with supporting data.

Referee: 3

COMMENTS TO THE AUTHOR(S) [See also $ER_{systemappendPDFproofhi.pdf}$] Nice paper. Comments are on the attachment. The paper needs some clarification of methods and a little

more discussion, but overall it is a very good paper. My main issues relate to using the Akbari and Konopacki results to extrapolate to the nation; how you were able to separate shade and wind effects; and the discussion should delve more into why these patterns occurred.

One item you might want to expand on in the discussion is that though your results contradict most, but not all, results for northern climates, they do not necessarily negate the findings of past studies. It opens an interesting question for more research though. You basically have an analysis of one city (the national analysis is questionable). Other studies used energy simulations that had limitations, but your results do not necessarily render previous studies as incorrect. Past studies have found these negative winter effects, but maybe not to your degree. Your work is interesting and opens questions for further research, but is not conclusive nationally. Your work compares one modeling approach results with other modeling approach results; and both have limitations. Bottom line is that trees in more northern climates could increase carbon emissions and more research is needed as to how much and why.

Comments on pdf (lines are from original submission):

- Title. Maybe add "due to altered energy use" in the title as your findings indicate that if sequestration is included, carbon has a net positive sequestration.
- line 126. This difference also has to do with the ratio of emission to the fuel source. If one changes the fuel, the C emissions will change but the energy effect will stay the same.
- line 142. "So the tree is a net reduction in C? Maybe report the net effect of both to be clear"
- line 147. "How do you know shading was the driving factor, vs transpiration or wind? Also how does comparing winter vs summer effects lead to the conclusion for winter effects?"
- line 153. "Good"

- line 161. "Why might this be?"
- line 178. "Although I agree with this conclusion, I find it somewhat contradictory that the basis for this work in the introduction is the limitations of past studies, but you use these past studies to extrapolate nationwide. Why not just use your findings to make this point - in heating dominated areas, tree can increase C carbon emissions. Extrapolating the Akbari data is suspect due to their assumptions on tree cover. Your data are from actual tree distributions. I would drop this national analysis as it is already known that trees can increase winter energy use. Use past studies to back your findings. Also note that fuel mix is important in carbon emissions as is tree location."
- line 184. "McPherson and Simpson methods are used in iTree, but it is not the model."
- line 185. "Northern"
- line 188. "How did you separate out shade effects?"
- line 192. "I am confused as to how you can separate or did separate wind from shading effects"
- line 218. "It might good to note that this information can also be used to improve planting designs, particularly in colder climates to reduce energy use and carbon emissions"
- line 235. "Good"
- line 267. "Again, I do not see how you conclude this difference between wind and shade."
- line 309. "What is the accuracy of the tree cover data?"
- line 327. "What is the accuracy of the building cover data?"

- line 374. "This is confusing text as to what was actually done. Are you interpolating Akbari and Konopacki results to this area with 77% of the population? If so, how to do you account for varying tree cover across the nation? The Akbari paper uses 4, 8 and 10 trees around the building for their assumption of tree cover. If you are arguing that these previous models have limitations based on their assumptions, why use these models for national extrapolation. I may be misreading these methods, but either way, these methods needs to be clarified."

Letter reference: DSMa01