

Comments on “Northward shift of boreal tree cover confirmed by satellite record” by Min Feng
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The submitted manuscript reports on the magnitude, direction, and significant changes in the distribution of the boreal forest between latitudes 47°N and 70°N. The analysis is based on estimated MODIS VCF, which were calibrated with lidar observations. These calibrated estimates were then downscaled to 30-m spatial resolution using Landsat data from 1985 to 2020, employing a gradient-boosted regression tree machine learning model.

The authors identified a systematic extension of the boreal forest cover further towards the North pole. This offsets the decrease in tree cover in the southern part of the boreal zone, resulting in an overall increase in boreal tree cover. From a local perspective, different trends in the forest cover patterns and distributions are observed, and further detailed investigation is required in the future. Based on 36 years of satellite data, an estimate of potential CO₂ uptake is provided. The authors suggest that this additional uptake could partially compensate anthropogenic CO₂ emissions. The authors clearly point out the uncertainties associated with the limited data set and the method applied in the study. Uncertainties arise from, for example, uncertainties in estimated tree age, the influence of temperature on tree growth, the soil's capacity to maintain a growing forest, and anthropogenic fire events. Therefore, the text raises awareness of the potential limitations associated in the provided estimates. Throughout the text, the authors contextualize and compare their findings with recent literature.

I have only some minor comments and I would like to ask the authors to consider them in the next version of the manuscript.

Minor comments:

- L36, L49, and others: Using " \leq " in this way seems strange because, strictly following the mathematical interpretation, "increasing" cannot be greater than or equal to "1.4°C." It reads much better written out, and it doesn't add much text. Please consider rewording "<", ">", or " \leq " in all instances.
- L37: Please define "C" at the first occurrence. I know that you are referring to carbon, but it should be defined here. It is defined later in line 45, but this is too late.
- L78 and elsewhere: When you cite the supplement, why do you write "SI". What does SI stand for?
Further, using, e.g., §2-4, does not really help, when the paragraphs in the supplement are not numbered. Having to count the paragraphs from the beginning is cumbersome. Please number the paragraphs in the supplement.
- L83 to L88: Please check: The process of downscaling and calibration of MODIS CVF is mentioned twice! Please remove one of the two instances.
- L88: Even though these abbreviations and acronyms are known in the community, it would be good to explain and give the full names for TM, ETM+, OLI, and WRS-2.
- L97: Maybe start the sentence with "Tree cover [...]" instead of "Cover [...]"?

- L98: As mentioned before, please write "pixels with less than 30 [...]", for example.
- L107: Fig. S13 on one line
- L110: It would be helpful if you could explain what you mean by "disturbance". Although one can understand it after reading the subsequent lines and the supplement, but one should be able to understand the paper without reading the supplement first. For example, provide a short definition of what you regard as a disturbance. Reading the text for the first time, I asked myself if disturbance means: no data, decrease or increase in forest cover, or complete loss of tree cover.
- L117: Try to be consistent. Sometimes you use "SI" when you refer to Fig. in the supplement, like "SI Fig.SX", and other times you only use "Fig.SX". "SI" is not necessary required when writing "Fig. SX", since "S" already directs to the supplement. You may want to consider that.
- L124: Should the bracket behind "58.4 Pg C" be removed?
- L128: "...using two reanalysis products. Both records indicated significant warming... " Please be more specific and state which records you used. Mentioning the data sets in the supplement is not sufficient, in my opinion and they should be mentioned in the text.
- L137 and L138: After reading the these two sentences, I asked myself what the difference is between "boreal tree cover" and "tree cover". What is meant by the general "tree cover"? Are these different regions? Please explain, and accept my apologies if I missed that.
- Fig1: The right hand side "tree cover" color bar is doubling with the color bar on the left hand side. I do not have a strong opinion about that but you may consider removing the color bar on the right hand side.
- L136: Do you mean Fig.2? Please check?
- L168: Is it fair to calculate the rate of change by selecting two years, here 2000 and 2020? By choosing a different combination, a negative trend could be created, e.g., using 2004 and 2020, which would create a negative trend. Did you calculate the rate over all 10 years or using only the two years?
- L225: Please be more specific and state which region you are referring to.
- L233: Please specify what you mean by "young," for example: "..., with a notable lapse in the youngest age classes with trees younger than 8 years."
- L264: Please check "root:shoot". Is the colon correct?
- L266: Avoid a line break between the number and unit here and elsewhere.
- L275: Consider explaining "CO₂" on the first occurrence.
- L295: You might consider calling it a summary instead of a conclusion. To me, the two paragraphs read more like a summary.
- L298: Please clarify what you mean by "Landsat archive." The Landsat archive contains a variety of products.

Comments concerning the supplement:

- Fig. S4: In the lower most part of the figure, the arrows appear out of nowhere, and directly above, one line ends nowhere. Please check that the boxes and arrows are correctly aligned.
- L225: Please verify: "p(F)" appears three times.
- Fig S14: The red "interpreted points" are difficult to read between the black outlines of the countries. You may want to select a brighter color or one with more contrast.
- L309-311: Please no line break there.
- Fig S16: Please provide a legend in the figure to explain the different colors, particularly for the lowermost left panel. Currently, it is only possible to infer indirectly which color represents regrown forest and which represents new forest. Also, homogenize the subtitles. Sometimes "Forest" appears in the title, and sometimes it does not.
- L347: Q10 is not defined. I guess it's the 10th percentile. Please define it at the first occurrence.