

Interactive comment on “Spaceborne potential for examining taiga-tundra ecotone form and vulnerability” by P. M. Montesano

Anonymous Referee #4

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This paper presents how spaceborne remote sensing data (high resolution and medium resolution) can be used to predict Taiga-Tundra Ecotone (TTE) form and structure at a forest patch scale. The authors present a two-step methodology, by first estimating patch height directly from Lidar data, and then using these direct estimates in a random forest algorithm to predict patch height indirectly in the remaining patches. The uncertainty linked to these methods and their results are reported and examined in details. It is a very interesting work, highlighting the importance of such studies for environmental science. The combination of the individual trees / forest patches / coarser remote sensing data is definitely a very interesting approach, that could potentially be applied in more studies on forests around the globe. The paper is clearly written, easy to read and covers topics that are suitable for BGD. However, I would recommend some minor changes that would help improve the paper :

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1) The paper is lacking some basic definitions and descriptions of terms the authors are using. How do they define terms such as “patches”, “form”, “vulnerability”, “plot” vs. “stand”. Issues related to TTE form determination are examined throughout the paper, but vulnerability is not directly addressed. The authors should make it clear from the beginning of the paper that vulnerability of forest patches can be directly linked to forest structure. This idea is suggested throughout the paper but is not stated clearly at the beginning. 2) One of the main conclusions of the study is that because the uncertainty is around 40%, remote sensing data, as presented in this paper, is not able to distinguish forest patches in terms of height or structure. Although this point is clear in the discussion and conclusion, it is not really covered in the abstract. 3) P.2, Line 3 : why “asynchronous”? Explain or remove from abstract. 4) The introduction is clear and interesting, but it would be nice to put the role of TTE into a more global perspective (how much do they represent, in terms of forest cover and/or biomass, why is it important to study them. . .) and to mention climate change and its impacts on TTE. 5) P.4, L.18-21 : Sentence is not clear. 6) The authors are using thresholds to mask or classify their remote sensing data, but do not explain how or why they picked these thresholds. What NDVI threshold did they use? Was that choice based on other studies? Why did they use a roughness threshold of 5.5? Same question for p.9, l.11. 7) p.7, l.11-14 : Ground reference data should be described in more details here. What kind of measurements have been made? Why are they outside of the selected sites? 8) p.8, l. 11 : define DSM (definition given p.9). 9) P.9, l.15 : mention GLAS footprint size and explain why you used a radius of 10m (l.23). 10) P.12, l.8-10 : I find this sentence and Fig 3b misleading. The fact that the sampling density is higher in smaller patches is simply due to the fact that the authors only selected the patches that had GLAS shots in them, hence giving a higher number of samplings per ha in small patches. The reader should be reminded of this fact here. Adding the average and maximum number of samples per patch in each class would give a better idea of the distribution of samples, in addition to figure 3b. 11) P.12, l.15 and figure 4 : what do you mean by plot/stand? 12) P.12, paragraph 3.2 : a) Why are the ground data plots

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outside of the selected sites? Does it make a difference? b) Why are the calibration and validation sites separated spatially? Are the two areas similar in terms of topography, forest structure. . .? Wouldn't it be better and less biased to select them randomly for calibration or validation? 13) p.17, Discussion : The authors could mention future spaceborne missions, such as GEDI, and the possibilities they would bring for this kind of studies. 14) P.17, l.14-17 : Sentence is not clear. Reformulate. 15) Did the authors take the shape of GLAS footprints into account? GLAS footprint is not always exactly a circle of 60m diameter and these differences might have an impact on the results, if not taken into account. 16) P.19, l.19-13. Not clear, reformulate.

Comments about figures : Figure 1 : Why are the study sites so far away from the ground reference sites? Their height and structure characteristics might be different than the ones of the study sites. Figure 3 : a) I recommend to normalize the histograms, to make the two datasets more comparable. Instead of # of forest patches, show frequency (# / total # of each dataset). b) see comment 10). Figure 4 : a) and b) do not match caption. a) : see comment 12b. b) Normalize histograms. c) In caption, add "50th, and 75th percentile of mean height" for clarity. Figure 7 b) Normalize histograms It would be much easier to compare the direct and indirect histograms if they were all normalized.

Specific comments : 1) p.2, l.2 : "changes" instead of "change", or "occurs" instead of "occur". 2) P.4, l.24 : comma is not necessary : "group of trees, may help". 3) P.5, l.2 : remove "and" in "biodiversity, and biogeochemical". 4) P.5, l.26 : replace "," by "." In "structure, however". 5) P.11, l.11 : remove "the" in "specifying the both number". 6) P.19, l.9 : "explains" instead of "explain". 7) P.22, l. 9 : "suggest" instead of "suggests"

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