

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

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Responses to RC1

Comment 1. Sections 1.3 and 1.4 may benefit from a little restructuring though: 1.3 starts by discussing general principles but then jumps to the implied conclusion that spaceborne LiDAR data will provide the necessary characterisation of height structure. Are there other (perhaps less promising) possibilities that should be discussed here, for example radar (or is this implied within the meaning of HRSI)? Section 1.4 is again general, so I think it logically belongs earlier than the decision to focus on the use of LiDAR data.

Response: We agree that these two sections can benefit from some minor restructuring. We will clarify that the approach to which we refer involves is a general multi-sensor

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one that includes passive and active remote sensing from multispectral imagery, LiDAR and SAR at a variety of spatial resolutions. We did not intend to get specific in section 1.3, but rather point out that a patch-level approach that incorporates data from a range of sensor types may help capture both vertical and horizontal TTE patterns. To this end, our edits will provide a cleaner transition between Sections 1.3 and 1.4.

Comment 2. 2.2 (data acquisition and processing) is a bit hard to follow at times and needs more detail. Was the NDVI calculated from reflectance data or just from the uncalibrated pixel values of the HRSI data? And if the latter, were they atmospherically corrected first? How was the NDVI threshold determined? I think the processing to roughness needs some more information too. The approach used here is modelled on that used by Johansen et al (2014), but they were working with air orthophotos with a pixel size of 10 cm while the present work uses worldview imagery with pixels roughly ten times larger. How if at all do the different spatial and radiometric properties of the imagery affect the processing – e.g. choice of thresholds, kernel sizes? If different choices were made here than by Johansen et al, how were they informed? The rest of the methods section is clear.

Response: We agree that this section can benefit from a bit more detail. Our approach for separating vegetation and non-vegetation was to use NDVI calculated on uncalibrated digital number values of pixels and a threshold determined from a sample of vegetation and non-vegetation patches to provide a preliminary veg/non-veg mask. This preliminary mask was modified with image roughness information to identify forest from non-forest vegetation. Our approach involving image roughness is resolution independent in that feature roughness can be captured as long as those features are resolved in the imagery. Johansen et al. use 10cm data to identify individual banana plant leaves, while we use ~60cm data to capture groups of larch trees. This methodology captures image texture derived from variations in image brightness that is a result of the arrangement of trees across the landscape. An exhaustive examination of the influence of varying (1) kernel sizes, (2) image radiometry, and (3) thresholds on the

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identification of forest patches was not explored in this study. We will add mention of this in the Methods section. See also Comment #6 from responses to Reviewer #4.

Small details (by page/line number) 2/3 'asynchronous' – the word was unexpected here: you haven't said anything previously about structural changes being asynchronous, and I did not really understand what point you were making in using it.

Response: We will remove this term from the abstract.

4/1 'in the boreal' – the noun is missing! 4/8 'provide' → 'provides'

Response: These changes will be made.

5/7 'Spaceborne uncertainty' isn't quite the right phrase, I think, since the uncertainty hasn't originated in space. Maybe it needs a longer but more precise heading, such as 'uncertainty in spaceborne characterisation of TTE structure'?

Response: We will consider rewording this heading in the next version of the manuscript.

5/10 'However. . . single active sensors. . .' I was a little puzzled by this phrasing. I don't think the work cited in the previous sentence uses exclusively active sensors (like LiDAR and radar), so am not sure what the 'however' is contradicting.

Response: We agree that this sentence is poorly worded and will be re-worked in the next version.

7/3 'sparse gradient in tree cover' = low gradient in tree cover, or sparse tree cover (or some combination of the two)?

Response: We agree that this term is not clear. We should say, as do our references, that this region features open or sparse tree cover.

7/26 'of primarily' → 'primarily of' 8/6 'backscatter power' → 'backscatter coefficient'

Response: These data were in power units (0-1). 8/11 'DSM' I think this abbreviation

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is used here for the first time, so should be spelt out. 8/13 'attribute forest patches with the mean and variance. . .' This doesn't seem quite the right usage. Maybe you could say 'attribute the mean and variance. . . to the forest patches'. 8/29 'kernal' → 'kernel' 9/4 're-binned' → 'resampled' 9/19 'were filtered' → 'was filtered' 9/27 'attributing...with' – see 8/13 10/14 'attributed with' – again 15/24 superfluous 'the'. 'Theses' → 'These' 18/27 'describe' → 'describes' 22/3 'derived from a suite of. . .' → 'derived from a specific suite of. . .' 29 'backscatter power' → 'backscatter coefficient' Response: See above 29 'scale' (in column heading) – would 'spatial resolution' be preferable? 33 figures (a) and (b) have been transposed.

Response: The edits suggested above will be made unless otherwise noted.

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