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Interactive comment on "Soil carbon, available nutrients, and iron and aluminium crystallinity vary between boreal closed-canopy forests and open lichen woodlands" *by* Carole Bastianelli et al.

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Dear referee,

Thank you very much for your constructive comments and suggestions for improvement and clarification.

As suggested, in the revised manuscript we plan to emphasize the novelty of our approach and give more precise details about the context of our work at the end of the introduction.

Here are individual responses to your comments and some details about the revisions

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we plan to make for a final acceptance:

- Comment 1: We are working on a title change in order to make it more impactful and we won't mention available nutrients.

- Comment 2: The term nutritionally poorer generates confusion and will be removed.

- Comment 3: We will make the sentence clearer and add elements for clarifying our assumption Revised version: "we also hypothesized that the podzolisation process and hence iron reactive chemical species would be different depending on the local vegetation density. We assumed that the conditions found in soils covered by a lichen mat with low-density canopy would be more prone to iron and aluminium oxide accumulations than MF soils. Schaetzl et al. (2015) argued that water fluxes have a great influence on the intensity of podzolization especially because they control the mobility of soluble organic complexes onto the soil profiles. Snow, snowmelt and deep percolation may thus vary between MF and LW because of tree density and lichen/moss cover.

- Comment 4: We corrected the info about the number of degree days to make it clearer Revised version: "The number of degree days above 5°C for the period 1981-2010 was 817 per year"

- Comment 5: We will add details about the methodology used for C and N contents measurement Revised version: "Total C and N contents (%) were measured on all soil samples by combustion using an induction furnace (Leco® TruMac CNS Analyzer) following sieving at 2mm, drying and ground at 0.5 mm. The combustion is performed at 1350°C under an oxygen gas atmosphere which turns C and N forms to CO2, N2 and NOx. Gaz concentrations are the determined by thermal conductivity and infrared detection."

- Comment 6: We will add some info. Mehlich is a well know method that is mainly used to determine exchangeable cations. The fluoride contained in ammonium fluoride promotes P desorption by decreasing Al activity and by forming Al-Fl complexes. It is

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appropriate for assessing P availability in acidic soils. Revised version: “The Melich-3 solution mainly extracts exchangeable and soluble cations and phosphorus under aluminium, calcium and iron phosphate forms.”

- Comment 7: We are not entirely aware of the reasons: as noted by the authors (Johnson and Todd, 1983; Pagé and Kimpe, 1989) Aloxa is high in these soils due to the importance of amorphous forms of Al as was as that of Al-organic matter complexes. Revised version: “McKeague et al. (1971) showed that these two extractants are less useful in distinguishing species of Al in soils than for Fe species.”

- Comment 8: Soils in MF contain more organic matter, which explain the darker horizons. We will add some info about colorations and Fe oxides concentrations.

Revised version: “The more important the pedogenic process of Fe reduction and subsequent removal are, the less colourful the soils are, displaying mostly the grey colours of the silicate matrix (Schwertmann, 1985). It is thus likely that pedogenic processes differ between lw and mf plots.”

- Comments 9 and 10: P was not the focus of this study and in fact it did not strike out as being linked to the type of forest studied. We measured extractable P in the C horizon to evaluate if the parent material was different between the two environments. The difference that appeared here was minor and, as it was higher in LW suggested that the differences were minor enough that it did not play a role for ecosystem development.

- Comment 12: As suggested, we will improve our discussion and give further elements to discuss why Fe and Al oxides could behave differently depending on the pedoenvironmental conditions. Revised version: “The conversion reactions of iron oxides depend to a large extent to pedoenvironmental factors (pH, water activity, temperature, etc.) (Schwtermann, 1988). These factors vary with depth and depend on the groundcover. Furthermore, organic matter seems to have an influence on iron oxides by inhibiting their crystallinity (Borggaard et al., 1990): in mf plots, the thicker and denser organic matter layer could explain the lower concentrations of Fe and Al oxides in B

horizons. Fe and Al oxides species could also differ between mf and lw plots because soil temperature and moisture are also responsible for different goethite:hematite ratios (Schwtermann, 1988). Hematic soils develop in warmer conditions and are characterized by reddish brown colors while goethitic soils develop under colder environment and turn yellowish-brown. This is consistent with our observations of clearer red to yellow soils under lw cover where little organic matter accumulates as opposed to mf soils overlay by a thick dark brown organic layer which could lead to warmer temperatures."

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