

## ***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.***

**Anonymous Referee #3**

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### General Comments

This manuscript investigated different soil properties and soil horizon development between boreal closed-canopy forests (MF) and open lichen woodlands (LW). The authors found more organic carbon and exchangeable base cations (Ca, Mg) in MF humus than LW soil. The B horizon of LW sites contained more amorphous Fe/Al oxides than MF mineral soils. The authors have done solid research work about detailed comparison between two forest ecosystems for soil chemical properties, Fe/Al reactive species, covariance between vegetation and soil geochemical variables, and so on. The manuscript is easy to follow, well written and logically structured. However, some weaknesses and discussion need to be improved. The title of this paper is “soil

C1

carbon, available nutrients, and iron and aluminium crystallinity vary between boreal closed-canopy forests and open lichen woodlands”. However, there is rare discussion about why available nutrients vary between these two forests. Although section 3.4 discussed P distribution, it only focused on the comparison among different soil horizons not between the two forest soils. Also, the authors emphasized the difference of iron/aluminum between two forest systems and attributed it to different pedogenetic development under MF and LW cover. However, there is no deeper discussion about how the pedogenetic development accumulated more amorphous Fe/Al in B horizon of lw than mf. Additionally, the novelty and uniqueness of this paper are not clear in the introduction.

Other special comments:

Comment 1: the title could be improved. As mentioned before, the comparison of available nutrients are rarely discussed.

Comment 2: Page 2 line 9: The authors mentioned lw soils were nutritionally poorer. Which kind of nutrient do you mean here? If authors emphasized phosphorus, the concentration of phosphorus in FH horizons does not have significant difference between two forest ecosystems.

Comment 3: Page 4, line 19-21. The assumption is no clue from former description.

Comment 4: Page 5. Line 1: It is confused that annual sum was 1186.4 and please make it clear.

Comment 5: section 2.3.1. Could you provide more details about the C and N contents measurement?

Comment 6: Section 2.3.2. Please give explanation about which fraction of ions and phosphorus could be extracted by the Mehlich-3 solution.

Comment 7: Page 7 Line 5-6: “Quantities of Al extracted by oxalate (Aloxa) may be higher than quantities extracted by dithionite citrate (Aldit) in some cases such as in

C2

acid soils or podzols." Please explain the reason.

Comment 8: Section 3.1: Provide further explanation how the different concentration of Fe oxides and vegetation cover between lw and mf plots lead to the light yellow color in lw plots and darker and browner color in mf plots.

Comment 9: Section 3.2: Please give more discussion why extractable phosphorus is higher in lw C horizon than in mf C horizon, and why there is no significant difference of phosphorus in B and FH horizons between these two forest soils. The authors only mentioned that the accumulation of products of mineral weathering as well as the migration of organic P compounds could explain this different, but it is still not clear for audiences.

Comment 10: in section 3.4, the authors discussed the P distribution among different soil horizons and found lower concentration of extractable P in B horizon than FH and C horizons. Have you done the statistical analysis about it? Is there significant difference between B horizon and FH/C horizon? Also there is no explanation why FH horizon have more P than B horizon. What is the relation between the enrichment in organic C and high concentration of extracted P in soil?

Comment 11: Page 11, line 7-10: "The different behaviours of exchangeable Fe and bound Fe could be explained by their different mobility properties and abilities, in particular since fluxes could vary under different soil environment conditions and thicknesses between lw and mf plots." I think authors should give further discussion how different fluxes and thicknesses between lw and mf plots affect the mobility properties and abilities of exchangeable Fe and bound Fe.

Technical comments:

Page 8 line 18: "(Fig. 1b) and 1c)". Delete the ")" in the middle.

Page 12 line 1: "found" changed to "find".

Fig. 4: give explanation about Alpyro, Aloxa, Aldit, AISRO, Fepyro, Feoxa, Fedit, C3

FeSRO behind the figure or on the figure caption.

Table 2: provide the explanation about CEC, FeSRO, AISRO and FeCRI on the table caption.

Table S1: provide the units of P and metal species.

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