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Discussions

Interactive comment on "Leaf trait variation and field spectroscopy of generalist tree species on contrasting soil types" *by* Matheus Henrique Nunes et al.

Anonymous Referee #2

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The article "Leaf trait variation and field spectroscopy of generalist tree species on contrasting soil types" by Nunes and co-authors analyzed field spectroscopy data collected on different European tree species on contrasting soil types. The authors worked with 24 leaf traits and explored the following questions: What contribution do soil type and species identity make to trait variation? When traits are clustered into three functional groups (light capture and growth, leaf structure and defence, as well as rock-derived nutrients), are some groups more affected by soil than others? What traits can be estimated precisely using field spectroscopy? Can leaf spectra be used to detect inter-soil as well as inter-specific variation in traits? The authors found that most leaf traits varied greatly among species. The effects of soil type were generally weak by comparison

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Specific Comments:

Line 28 variation in foliar traits and Si predictions using spectroscopy appear to be promising. Not clear what Si means at this stage, it becomes clear later. But in general all the discussion on Si is poor

Line 162 We recognize that grouping leaf properties into functional classes can be controversial, given that a single leaf property can contribute to This is particularly true for P, this assumption has to be justified as foliar P can be easily considered a trait associated to growth

Results Section Spectroscopy of leaf properties The results of PLSR are on one hand encouraging because the portion of spectra selected for specific traits are in line with what expected from the literature. Some examples from the article:

1)higher goodness-of-fit were obtained for K, Ca and P in the SWIR regions. 2) Pigments were the only traits that predictions were more accurate when using the visible region (400 – 700 nm)

I think would be useful to have more discussion on what is known and what is new compared for instance to the review from Homolova et al., which discuss many of the traits mentioned by the authors and how these traits can be predicted from remote sensing data. What do we learn from these results? I think the authors should make an effort to improve this aspect because can be quite relevant considering the great dataset they have. For example a figure with a reflectance spectra with an indication of the regions relevant to estimate other the traits indicated migh be useful for the reader.

Line 267 The species x soil interaction effects were detected by PLSR modelling, except for traits that showed strong interaction (Mn, P and δ 13C)

This should be better discussed

Line 279 Our findings that trees growing on the chalk soils had relatively low concentrations of N, P and K in their leaves, and relatively high concentrations of Ca, Mg, B,

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Mn, Si and Zn, is consistent with previous analyses of mineral nutrition in calcareous soils

Please add a reference here

The discovery that structural and defensive traits do not vary with soil is consistent with a previous study in New Zealand's lowland temperate rain forests (Wright et al., 2010). That study compared traits of trees growing on phosphorus rich alluvium versus phosphorus-depleted marine terraces. Foliar phosphorus concentrations of species were halved on the marine terraces, but there was no detectable variation in structural traits, phenolic or tannin concentrations.

I would add more discussion at line 298. At the moment is more a description of results. Please specify at the beginning which traits are you talking about and why they do not change between poor and rich soils:

"Water" was defined as trait. Please define exactly what do you mean with water and how this was computed also here

Line 304: Species had a greater influence on trait values than soils for all traits, except P.

This makes completely sense to me because the content of P in leaves should be more related to the P available in the soil for the plants and not too much to the species. But again I found the discussion poor. There is a lot of literature about the leaf stoichiometry and P stoichiometry and the relationship with physical and chemical properties of the soil. Also with the database the authors have they can also explore how the reflectance is related to ration such as C/P N/P or C/N ratios.

Line 350 The region of importance with correlated wavelengths with nitrogen varies between 1192 nm in deciduous forest (Bolster et al., 1996) to 2490 for forage matter (Marten et al., 1983), which results directly from nitrogen in the molecular structure.

Please also cite other recent papers showing similar results with spectrometers similar to the one used in this study (e.g. Homolova et al., 2013).

Line 353 Although chlorophylls also contain nitrogen, the spectra of chlorophylls differ greatly from proteins because of their dissimilar chemical structures, showing strong absorption due to C-H bonds in the phytol tail of the molecule (Katz et al., 1966),

Here if I understand correctly the authors they want to make the point that Chl and N are estimated with different regions of the spectrum despite N is one component of Chl and should covary. If my interpretation is correct I suggest another line of argumentation: Nitrogen Chl are contained in the green vegetation and N content and Chl are correlated (see Houborg et al., 2013). However, in dry leaves there is only N and not Chl. And therefore we cannot expect that the PLSR select similar regions for Chl and N.

Homolova, L., Malenovsky, Z., Clevers, J.G.P.W., García-Santos, G., Schaepman, M.E. Review of optical-based remote sensing for plant trait mapping (2013) Ecological Complexity, 15, pp. 1-16.

Houborg, R., Cescatti, A., Migliavacca, M., Kustas, W.P. Satellite retrievals of leaf chlorophyll and photosynthetic capacity for improved modeling of GPP (2013) Agricultural and Forest Meteorology, 117 (1), pp. 10-23.

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