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Interactive comment on “Underestimation of boreal soil carbon stocks by mathematical soil carbon models linked to soil nutrient status” by B. Tupek et al.

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General comments This is an interesting paper. Three structurally quite different soil carbon models give very similar predictions of forest soil carbon stocks when they are driven by the same litter inputs and differ also similarly from observations. The critical question is why they fail in their predictions for 22% of the test sites. The authors attribute the failure to weaknesses in how the models handle soil nutrient status. This might well be the case, but such a failure can come from two quite different sources. On one hand, is the litter input correctly calculated? The procedure used to generate litter input is not transparent. The calculation is based on fAPAR (the fraction of absorbed photosynthetically active radiation) but the maximum/potential value of absorbed radi-

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ation seems to be ignored. However, both the potential production and fAPAR vary with the nutrient status of the stand. In the end, it seems to me that the procedure generates tree biomasses and thus litter production only depending on latitude; this will ignore the large regional differences in nitrogen deposition that play an important role in tree productivity, likely leading to an underestimate of litter production in high deposition areas. On the other hand, it is clear that soil nitrogen modifies the carbon use efficiency of decomposers; increasing nitrogen availability increases CUE, which increases soil carbon stocks (Ågren et al. 2001, Franklin, et al. 2003). In all three models, inclusion of either of these two factors would improve the model performance at the high nutrient sites.

Specific comments 1. Line 78. effects should be affects 2. Line 221. It is not clear what is meant by "the 2012Q model". Should it be 2011 or 2013? 3. Line 343. Why should decreased microbial demand for nitrogen lead to increased soil carbon? 4. Line 387. Why should inorganic nutrient uptake by mycorrhiza lead to underestimated SOC stocks on medium-highly productive sites? Cited literature Franklin, O., et al. (2003). "Pine forest floor carbon accumulation in response to N and PK additions - Bomb 14C modelling and respiration studies." *Ecosystems* 6: 644-658.

Ågren, G. I., et al. (2001). "Combining theory and experiment to understand effects of inorganic nitrogen on litter decomposition." *Oecologia (Heidelb.)* 128: 94-98.

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