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Interactive comment on "Organic nitrogen storage in mineral soil: implications for policy and management" *by* A. H. Bingham and M. F. Cotrufo

Anonymous Referee #1

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General comments.

The authors clearly and concisely summarize the current knowledge on soil N. I largely agree with what is presented in the paper, and have no substantial comment to make on hat is presented in the paper. Minor comments are: (i) acknowledging the fact that most of these results are for temperate soils, and (ii) suggested references to incorporate (see specific comments below). Other than that, I think that the review on N in soils is relevant, well written and well referenced.

My main comment deals with the implications for policy and management. While the review on soil N tends to cover all possible fates for the soil N, the implications for policy and management section is limited to few (relevant) processes (e.g., saturation, pH).

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Yet, the author state that “the current understanding of sequestered N [. . .] may also have implications for assessing the effectiveness of ecological restoration practices as well as mitigation strategies for reducing anthropogenic N inputs” (page 14, lines 4–9). I agree, but wonder how we can do that without taking into account the other factors that are known to influence soil N dynamics. Here are a few examples: (1) Invertebrates (e.g. earthworms). The introduction of soil invertebrates can alter SOM stocks (via bioturbation) – and SON dynamics. (2) Agricultural practices. Quid of intensive irrigation (irrigation makes the SOM more hydrophobic, what alters SON behaviors. . .), tillage (depth, period of the year. . .), open-fields (erosion, loss of biodiversity in the soils, etc. alter SON behaviors), N fertilization (quantity and timing –> effects on SON), intensive farming (nitrate...), etc ? The literature on how agricultural practices is particularly abundant, and the mechanisms are extremely well documented. (3) Climate change. Warming. Severe climatic events (drought, floods, etc.). Fires (savanna and forest fires keep increasing). (4) Ramping anthropization of soils. With urban areas in constant increase at the expense of rural areas, policy makers may want to know about how the expansion of the urban areas (i.e., urban soils) may alter SON dynamics and how to counteract/ mitigate such change. (5) Etc. Among the missing factors, many may be managed to optimize soil N and C cycling. As a consequence, I believe that the paper would benefit from a more exhaustive description of the factors that influence N dynamics in soils. These could either be incorporated in the current section 3 (in a paragraph – as for the pH), or separated out from the policy and management implications section. The later option (which I think is clearer) would require a new section that could focus on how these sus-mentioned controlling factors (and the interactions between these factors) influence SON, while the implications for policy and management section (current section 3) could focus on how to take advantage of or counteract their effects.

Overall, this paper is well within the scope of SOIL, and has the potential to be well cited. If I warmly recommend this paper for publication, I encourage the authors to extend their paper in scope as I believe it would reach an even broader audience.

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Alternatively, I strongly recommend boiling down/ clarifying the present scope of the paper, as many controlling factors relevant to soil N dynamics, policy and management are not treated.

Specific comments.

Page 10, lines 14–27: suggested references: (1) Kleber et al. 2005, Poorly crystalline-mineral phases protect organicmatter in acid subsoil horizons, European Journal of Soil Science, December 2005, 56, 717–725, doi: 10.1111/j.1365-2389.2005.00706.x (2) Keiluweit et al 2012, Nano-scale investigation of the association of microbial nitrogen residues with iron (hydr)oxides in a forest soil O-horizon, Geochimica et Cosmochimica Acta 95, 213–226, http://dx.doi.org/10.1016/j.gca.2012.07.001

Page 11: suggested references: (1) Hatton et al 2012, A multi-scale approach to determine accurate elemental and isotopic ratios by nano-scale secondary ion mass spectrometry imaging, Rapid Commun. Mass Spectrom. 2012, 26, 1363–1371, DOI: 10.1002/rcm.6228 (2) Lehman et al 2008, Spatial complexity of soil organic matter forms at nanometre scales, Nature Geoscience, 1, 238-242, doi:10.1038/ngeo155

Page 13, line 3-5: suggested reference: Hatton et al 2014, Assimilation and accumulation of C by fungi and bacteria attached to soil density fractions, Soil Biology & Biochemistry 79 132-139, http://dx.doi.org/10.1016/j.soilbio.2014.09.013

Page 14: I suggest emphasizing N and C interactions. Indeed, if we know that N deposition makes a minor contribution to carbon sequestration in temperate forests (Nadelhoffer et al, 1999, Nature 398, 145-148, http://www.nature.com/nature/journal/v398/n6723/abs/398145a0.html), we also know that the fates of N and C in soils are intimately related so that influencing the dynamic of one element necessarily impacts the other (Sollins et al, 2007, Biogeochemistry 85, 1–7, DOI 10.1007/s10533-007-9099-x). As a consequence, assessing practices requires considering both C and N simultaneously.

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Technical corrections.

Page 3, line 18: typo: humifacation –> humification.

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