

1           **Response to the Letter to the Editor Regarding Our**  
2 **Viewpoint “Sequestering Soil Organic Carbon: A Nitrogen**  
3 **Dilemma”**

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6 Jan Willem van Groenigen<sup>1\*</sup>, Chris van Kessel<sup>2</sup>, Bruce A. Hungate<sup>3</sup>, Oene Oenema<sup>1,4</sup>, David  
7 S. Powlson<sup>5</sup>, Kees Jan van Groenigen<sup>6</sup>

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9 <sup>1</sup>Department of Soil Quality, Wageningen University and Research Centre. P.O. Box 47, 6700  
10 AA Wageningen, The Netherlands.

11 <sup>2</sup>Department of Plant Sciences, University of California, Davis, CA95616, USA.

12 <sup>3</sup>Center for Ecosystem Science and Society (EcoSS), Northern Arizona University, Flagstaff  
13 AZ86011, USA.

14 <sup>4</sup>Alterra, Wageningen University and Research Centre. 6700 AA Wageningen, The  
15 Netherlands.

16 <sup>5</sup>Department of Sustainable Agricultural Sciences, Rothamsted Research, Harpenden, Herts.,  
17 AL5 2JQ, UK.

18 <sup>6</sup>Geography, College of Life and Environmental Sciences, University of Exeter, Exeter EX4 4  
19 RJ, UK.

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22 \*Correspondence to: JanWillem.vanGroenigen@wur.nl

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24 We welcome the response by Soussana et al.(ref. 1) to our viewpoint article; it is important to  
25 have a broad discussion within the scientific community on the feasibility and nature of the  
26 4p1000 goal. In particular, we welcome the explicit acknowledgment that the 4p1000 goal  
27 should be recast as “aspirational”, rather than actually achievable in a quantitative sense, as  
28 originally stated. Although this may be an increasingly common realization within the scientific  
29 community, it is certainly not common knowledge within the policy-making community and  
30 appears to represent a shift from the wording at the official 4p1000 site (<http://4p1000.org>). We  
31 suggest that the Web site wording be made clearer.

32           We disagree with the statement by Soussana et al. that the 4p1000 goal is already  
33 sufficiently spatially diversified because it is related to the local soil organic C (SOC) stock.  
34 This implies that soils with a large SOC stock will normally have a larger nitrogen (N) (and

35 phosphorus, P) surplus than those containing less SOC. We fail to see the rationale for their  
36 statement in two ways. First, at the global scale, many soils with a large SOC stock will be  
37 extensively grazed grasslands (rangelands) (ref.2) which typically have small N and P inputs  
38 and small surpluses. In contrast, many intensively managed arable soils, which typically have  
39 lower SOC stocks (ref. 2) have large inputs of N and P leading to large surpluses (ref. 3) Second,  
40 in general, soils with a low SOC stock (e.g., old arable soils, degraded lands, mine wastes) have  
41 greater potential for increasing SOC than soils with high SOC stocks (ref. 4,5). Focusing C  
42 sequestration efforts on these soils would seem advantageous, both for climate change  
43 mitigation and for improving soil quality (ref. 6).

44 As Soussana et al. state, the aspirational 4p1000 goal is an incentive for more judicious  
45 soil management that may reduce N losses from the soil, through for example planting cover  
46 crops and legumes as well as implementing measures to reduce soil erosion. We welcome these  
47 efforts which certainly would contribute to increased C storage and improved soil quality, but  
48 as we argued in our viewpoint article, the additional N required to meet the 4p1000 goal is so  
49 high that it is impossible to reach the goal with these measures.

50 We agree with Soussana et al. that not only N but also P plays an important role with  
51 respect to the 4p1000 goal. Whereas it is true that legumes are often better able to acquire P  
52 from P-depleted soils than cereals and vegetables, we are not aware of any conclusive evidence  
53 in the literature that this would contribute substantially to the 4p1000 goals. There is certainly  
54 a need to study the interactions between P availability, plant growth and C sequestration for a  
55 range of crops. Nutrient (N or P) limitations to C sequestration cannot be ignored.

56 The 4p1000 aspirational goal is a powerful reminder of the enormous importance of soil.  
57 It should serve as a wake-up call for judicious soil management. However, as a soil scientific  
58 community we have to be careful not to oversell our story as we might have done in the past  
59 (e.g., by overpromoting the benefits of soil biochar amendment) as it may hurt our credibility

60 and work counter-productively (ref. 6). The good news is that there is no need for that, as the  
61 case for increasing soil carbon storage, preventing soil erosion, and improving soil quality, is  
62 strong enough as it is

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