

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

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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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