SUSTAINABLE SOILS ALLIANCE

5 November 2019

Response to the:
Call for Evidence for the Review on the Economics of Biodiversity
led by Professor Sir Partha Dasgupta.

The Sustainable Soils Alliance (SSA) was launched in 2017 to address the current crisis in our soils. Its aim is to campaign to restore UK soils to health within one generation by seeing soil health elevated to where it belongs as a priority alongside clean air and clean water. The SSA is a non-profit organisation (CIC number 10802764).

1. Soil Biodiversity: Background:
   - The total biomass belowground generally equals or exceeds that aboveground, whilst the biodiversity in the soil always exceeds that on the associated surface by orders of magnitude, particularly when measured at the microbial scale.
   - A teaspoon of soil (about one gram) may typically contain one billion bacterial cells (corresponding to about ten thousand different bacterial genomes), up to one million individual fungi, about one million cells of protists, and several hundred nematodes. Beside microorganisms and microfauna, soil harbours different species of meso and macro/megafauna represented by arthropods, earthworms and mammals.
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   - The soil biota plays many fundamental roles in delivering key ecosystem goods and services. Ecosystems goods provided by soil biota are:
     - food production;
     - fibre production;
     - fuel production;
     - provision of clean water;
     - provision of secondary compounds (e.g. pharmaceuticals and agrochemicals).
   - Ecosystems services provided by soil biota:
     - driving nutrient cycling and regulation of water flow and storage;
     - regulation of soil and sediment movement and biological regulation of other biota (including pests and diseases);
     - soil structure maintenance;
     - detoxification of xenobiotics and pollutants and regulation of atmospheric composition.

   Source: Joint Research Centre, European Soil Data Centre

2. Soil Biodiversity: Policy
   - In Europe, soil policy is driven by both EU and national initiatives. We would specifically draw the Panel's attention to the European Commission's 2010 report: The factory of life Why soil biodiversity is so important, and the 2010 European Atlas of Soil Biodiversity which aims to inform and explain the unique characteristics of life in soil and raise awareness of its environmental importance and global significance.
   - Since then however, and due largely to the abandonment in 2014 of the proposed EU Soil Framework Directive, the significance of soil biodiversity has been overlooked by EU policy-makers, while the picture at national level is patchy with some Member States investing more in soil incentivisation, monitoring and enforcement than others.
   - The 2010 report concludes that action is needed to overcome in particular *the widespread lack of understanding about what goes on beneath our feet; there needs to be support for further research; and we need policies aimed at protecting soil and soil biodiversity in particular.* This situation still stands.

3. Soil health – casualty of growth-centric policy?
    - We would begin by challenging the framing of this review, which in our view is structured according to a historical and culpable legacy whereby economic growth through profits and yields is a primary goal. Indeed, we would argue that, as currently defined, economic growth may not in of itself be sustainable, especially without consideration of the bigger picture – in particular the requirements of the viable ecosystems on which life, let alone growth depends.
    - It is this short-sighted mentality that has motivated the environmental destruction brought about over the last two generations, but we would argue that the health of our soils provides the most critical, obvious – but also overlooked – evidence of this.
    - A third of the planet's land is severely degraded and fertile soil is being lost at the rate of 24bn tonnes a year, according to a 2017 report by the United Nations-backed Global Land Outlook. The report considered the interlinked impacts of urbanisation, climate change, erosion and forest loss but concluded that the biggest factor is the expansion of industrial farming.

4. Soil health: The economic and environmental unknown
    - Critical to this failure is the fact that at no point have we attempted adequately to attach a value to our soils, the quality of our soils and the product of our soils, one that includes both environmental services (carbon storage, flood prevention, biodiversity) and food production. For example, a recent Freedom of Information request by the SSA revealed that only a tiny proportion of England's spending on monitoring air, water and soil goes to soil monitoring.
    - There are significant gaps in current assessment methodologies and valuation systems for our soil. This has the effect that notional, rather than economic values are attached to losses, no one is incentivised to look after soil as a resource and the agriculture industry exploits the land - not because farmers want to, but because they are economically forced to.
    - We would draw your attention to the example of Sweden where long-term national monitoring programme has been in place since the 1980's whereby annual samples (60,000) from thousands of sites have been analysed, enabling them to identify long-term trends e.g. from climate change. Few countries/regions around the world have seasonal trends for carbon stocks.

5. Biodiversity and other soil services
    - So where does soil biodiversity fit into all this? Soil health is multifunctional so it would be impossible – and arguably counter-productive to consider soil biodiversity in isolation from the other ecosystem services it provides. The economics of soil biodiversity must instead be considered as a part of a much larger challenge of understanding the overall economic value of soil and the impacts upon soil functions and organisms that arise from different kinds of management.
    - Soil biodiversity is often tangential – arguably collateral damage in adverse effects of degradation of soil for example through continuous cropping without returning enough organic matter so that many of the UK arable soils are structurally degraded resulting in flood, erosion and pollution risks.
    - Most biodiversity metrics are indicative of overall soil health, however the correlation is not simplistic. Healthy soils are not necessarily biodiverse, while biodiverse soils are not necessarily healthy. We can say with some confidence that where we can correctly conserve the whole soil system, biodiversity will be protected and consequently the products and services that derive from it.

6. Soil management and biodiversity
    - When it comes to connecting soil management practices with biodiversity, we are constrained by the lack of a global or nation-wide monitoring of soil biology and health especially in relation to soil management, referred to above. We don't know what management systems deliver the greatest sustainability- there is evidence that no-tillage, use of grass-legume leys in arable rotations, additions of composts, crop residues and manures, cover crops and longer rotations are likely to be beneficial over continuous cropping, but optimal rotations and tillage systems for all crops including root crops is not known.
    - It would be an exaggeration to say that the prevalence of particular organisms is necessarily evidence of good farming practices, however as a first approximation, there are some indicator organisms that we know directly relate to some soil functions which might in-turn provide a cost-effective benchmark of

changes in soil quality. This would be an alternative to DNA identify everything, - especially when the majority of what is found may prove not to be identifiable or have no well characterised functions.

- There are keystone organisms in soils such as some types of earthworms that have been shown to directly influence soil structure and functioning and improve plant growth. Earthworm losses from intensive cultivation results in poorer soil structure and therefore flooding/increase and runoff. Earthworm populations are seasonally dynamic and very responsive to weather conditions so meaningful monitoring and inter-site and inter-year comparisons need to take this into account.
- The challenge of soil biodiversity raises the very particular challenge of no-till agriculture, which in many regions where it is practiced, is dependent on using weed killers such as glyphosate. Here the picture is unclear. Some studies indicate that glyphosate has adverse effects on mycorrhizal fungi while other studies where glyphosate is used on grass/clover and direct drilled wheat, better mycorrhization than under conventional management resulted.
- This reinforces the need to consider soil health in the context of an entire system and focus on biodiversity not just in terms of species numbers but species interactions and the outcomes of these interactions.
- Finally there is the area of disease suppressive soils - soils which are effective at reducing pathology or natural enemies e.g. aphids through their own biological control mechanisms, rather than chemical controls which have acted as a strong evolutionary selection pressure. Rebuilding biodiversity and complex trophic structures may in the long run be more sustainable than relying on chemical products, however biological controls may be less dependable and predictable.

7. Conclusion

As you can see, we have not looked to respond to the questions raised by the Consultation individually, because we felt – and wanted to highlight – that the necessary economic, technical – and even scientific research on soil biodiversity is not available, as it is for above ground biodiversity – and not in alignment with the way in which the questions are currently framed.

Instead, we wanted to provide a brief introduction to the unique circumstances of soil biodiversity, which we feel is in need of special consideration, and would draw your attention in particular to the following:

a) Agriculture, on which almost all life depends, depends in turn upon healthy soils which themselves require healthy biodiversity. Soil biodiversity is therefore as fundamental as – or even more so than - some of the other 'big ticket' biodiversity indicators (e.g. pollinators) and needs to be prioritised as such.
b) To do so, however, *the widespread lack of understanding about what goes on beneath our feet,* referred to by the European Commission needs to be addressed, and considerable international investment focused on this vital but misunderstood piece of the biodiversity picture. Only once the science of soil biodiversity is better understood should attention be turned to the economic argument.
c) Even then, soil health needs to be understood as a whole – i.e. as the sum of a range of environmental services which includes biodiversity, but also relates to carbon storage, flood management, productivity etc. These need to considered alongside one another, both to generate a full economic picture, but also because of the manner in which they inter-relate – with soil carbon the critical, central theme running through them all. Addressing soil biodiversity in isolation – whether for its economic or any other impact would be perverse.

On the basis of the above, we believe it is worth considering whether this Review is the correct vehicle to appraise soil biodiversity, or whether it is best analysed as a stand-alone investigation. It is our view that only a separate review framed specifically around soil biodiversity's unique circumstances and embracing the technical (practices), scientific (research) and evaluation (monitoring) elements alongside or in advance of economics would do this critical issue justice.