SUSTAINABLE SOILS ALLIANCE

Proposal for the Inclusion of 'Healthy Soils' as a Headline Indicator for the 25 Year Plan for the Environment

At the invitation of Robert Bradburne, the Science Panel of the Sustainable Soils Alliance propose the inclusion of 'Healthy Soils' as a Headline Indicator in the government's draft 25 Year Plan for the Environment, alongside three underlying 'Condition of Assets' indicators.

For clarity about how these indicators fit with the internal logic of the broader system as well as the specific goals of the framework we also provide:

- The source of the underlying data
- Technical summary for the new indicators
- Example of a potential reporting outcome for measurement indicators
- Explanation of how the new indicators meet the seven generic criteria for Indicator selection

There is clear political rationale for having Healthy Soils as a Headline Indicator.
Both the Prime Minister and Secretary of State for the Environment have highlighted the once-in-a-generation opportunity for the UK to develop a world-leading farming and environment policy post Brexit, underpinned by bold, visionary actions. What better way to showcase this ambition than the inclusion in the new framework – as a headline, and not buried in the supporting framework – of Healthy Soils, widely recognised as the most neglected and inadequately monitored of the key environmental indicators?

Crucially, the inclusion of Healthy Soils in a flagship policy also marks a clear departure from the current EU environmental framework which has not adequately prioritised or protected soils which are increasingly degrading in EU member states through erosion, loss of organic matter, compaction, salinisation, contamination, sealing etc. with adverse effects on human health, natural ecosystems, climate, and wealth-creation.

Healthy Soils are central to many of the 25 Year Environment Plan's stated objectives, namely to *deliver cleaner air and water in our cities and rural landscapes, protect threatened species and provide richer wildlife habitats* and broad intention to *replenish our depleted soils.* Given soil's pivotal role, we feel that any policy instrument that failed to adequately recognise – and prioritise – this would miss a vital piece of the overall picture, and so risk failing in its core objective of understanding how the environment as a whole is changing and why.

We consider this indicator comfortably fulfills the criteria set by Defra – in terms of meeting the needs of a wide variety of important users – from Ministers to land managers and the general public. It provides both a top-line account and a framework to connecting key contributing factors. It protects against displacement or leakage effects whereby soil improvements in response to farmer payments or other policy levers are not offset by intensification and soil damage on other land. Only a nationally unbiased metric can provide this overall picture of ongoing change.

In many ways, Healthy Soils provides a clearer, more dynamic and more comprehensible picture of both status and change over time in comparison with other indicators (e.g. biodiversity) that have been given headline status.

1. Headline Indicator No 16 'Healthy Soils' – Source data

A 'Healthy Soils' Headline Indicator for the Defra 25 Year Environment Plan can be supported by data from a CEH rolling topsoil (0-15 cm) monitoring programme coming on stream in 2020 which builds on a previous CEH monitoring programme started in 1978.

This new national estimate of change in soil condition will be refined annually as this rolling topsoil monitoring programme captures previously sampled locations over a five-year period (2019-2024). Data from this structured survey will be enhanced by other soil data sources where this is available.

Topsoil condition is recognised internationally as the most vulnerable soil layer most subject to change and thus a useful indicator of change over time.

The following five key parameters will be reported:

1. Bulk density – for soil structure, compaction, water storage (flood risk) and risk of nitrous oxide production (an important greenhouse gas)
2. Soil pH – important for biomass production, water quality and biodiversity
3. Soil organic carbon – (measured to 15 cm - important for carbon sequestration, crop nutrition and soil stability
4. Soil N – important for biomass/crop production and potential risk to water quality, nitrous oxide production (an important greenhouse gas) and plant biodiversity
5. Soil P – important for biomass / crop production and potential risk to water quality

2. Technical summary for the new indicators

Underpinning the Headline Indicator, we propose the following sub-indicators:

- H41 To ensure healthy soils in woodlands to support production, biodiversity, climate change mitigation and enhanced public goods.
- H42 To ensure healthy soils which ensure resilient and efficient agricultural production minimising leakage of contaminants to water and air
- H43 To ensure healthy soils to support biodiversity and enhanced public good provision from mountain, moors and heathlands

A sample technical summary (e.g. H42: Agricultural Soils)

- Short description: To ensure healthy soils, which ensure resilient and efficient agricultural production minimising leakage of contaminants to water and air
- 25 Year Environment Plan goal & target: Clean air; Clean and plentiful water; Thriving plants and wildlife; Reduced risk of harm from environmental hazards such as flooding, drought and nutrient enrichment of water and greenhouse gas emissions;
- Type: Asset condition
- If asset which: Farms, (water, air)
- Status: 1 - Published every year
- EU and other international reporting links: UN Framework Convention on Climate Change (e.g. the Land Use, Land Use Change and Forestry Greenhouse Gas inventory responsibility of BEIS (Please contact Peter Coleman of BEIS for more information); UN Sustainable Development Goals
- Geographical scope: England (data will also be available for Scotland and Wales and GB as a whole)

3. Measurement Outcomes

Table 1. is an example of a potential reporting outcome for measurement indicators proposed from the Defra / SSA Soil workshop autumn 2018 using data from the Welsh Government's GLASTIR Monitoring and Evaluation (GMEP) programme which includes a national scale monitoring component. Data are reported by 3 proposed sub-indicators for the new Headline Indicator H16 (Healthy Soils) and demonstrate how statistically significant trends for soil (0-15 cm) were recently reported. Values are converted to be positive or negative to reflect recognised benefit for soil condition (i.e. an increase in pH within threshold limits is considered positive (+) as this indicates improved conditions for production and recovery from acidification. This contrasts with a decline in nitrogen which is also considered positive (+) due to reduced risk of leakage to waters, improved resource use efficiency and reduced risk to biodiversity).

Overall report for H16 options at country level from Table 1. would be:

- Option 1: No change
- Option 2: Ongoing decline

Table 1. Changes in topsoil condition across Wales from GLASTIR monitoring programme (2007-16)

		Statistically significant (+ or -) or no (=) change in topsoil condition (2007-16)				
Sub -Indicator code	**Sub-indicator**	**Organic matter content /soil organic carbon**	**pH***	**N***	**P**	**Bulk density**
H41	Woodland condition	=	=	=	=	=
H42	Agricultural production	=	-	=	=	+
H43	Habitat condition	-	=	+	=	=
All Wales – Option 1	Sub-indicator (H41-H43) weighted by area it represents across the country	=	=	=	=	=
All Wales – Option 2	'Water Framework Directive (WFD)' type assessment where one significant change for any metric (for H41-H43) determines overall outcome.	-	-	+	=	+

4. Generic Criteria Application

Table 2.

Relevance	
The degree to which the indicator meets user needs	• Data is needed for UNFCC reporting with respect to greenhouse gas emissions related to land use, land use change and forestry. • Soil condition data also underpins biodiversity modelling work for the UNECE Gothenburg Protocol. • A national, robust metric is essential to ensure against displacement or leakage effects whereby improvements in soil condition e.g. in response to farmer payments is not offset by more intensive management on other land as seen previously in response to past Agri Environmental Schemes. • If national benchmarking and thresholds are not accepted – the data can still be used as shown above as improving or declining.

Focused on ultimate outcomes (see specific criteria for 25 Year Environment Plan)	Direct link to…. • Clean air – healthy soils have lower emissions of greenhouse gases • Clean and plentiful water – healthy soils have low rates of diffuse pollution and are able to store water for times of drought • Thriving plants and wildlife – healthy soils support productive and diverse biomass production, underpinning food chains and ecosystems. • Reduced risk of harm from environmental hazards – healthy soils store water to reduce flood risks in winter; they maintain soil stability to reduce soil erosion rates and risks of diffuse pollution • More sustainable and efficient use of resources – soils are central to the efficient use of finite nutrient sources and to the circular economies of 'waste to land' initiatives • Enhanced beauty, heritage and engagement with the natural environment – soils underpin our 'green and pleasant' land and protect our archaeological heritage.
<u>Sensitivity</u>	
The degree to which the indicator varies according to changes in the phenomenon	• Detection limits similar to those for other indicators where rapid acute changes in management post Brexit (e.g. conversion to arable).
<u>Availability and timeliness</u>	
Acceptable lag between availability of data and time period to which indicator refers	• Fast response to shifts in agricultural practices or land conversion to woodland (both projected under Brexit) would be observed within a few years comparable with other metrics.
Availability for use by others, collect once -use many times	• Past data co-owned by Defra and available through web portal with online manuals as to field and statistical methods. New data will be freely available subject to GDPR constraints concerning specific sampling locations and contracts with landowners.
<u>Comparability and scalability</u>	
Degree to which indicators can be compared over time and domain, scalable	• Methods directly link to past methods since 1978. Sampling points expanded in 1998 and all ongoing sampling will revisit the same sites.
<u>Accessibility and clarity</u>	
Ease with which users access and understand the indicator	• The 5 indicators have all emerged as the most valuable and interpretable of metrics during a series of farmer and Defra / SSA run workshops as being suitable for national monitoring and have been recommended in past Defra and EA reports on soil indicators.
Available metadata, illustration and accompanying advice	• All methods are available on line. These will be updated to capture the shift to a rolling programme and new data integration approaches to incorporate other data if/when this is available and Defra and devolved administrations consider it useful.
<u>Coherence</u>	
Degree to which indicators from different sources/methods referring to the same phenomena are similar	• The complexity of many other indicators relies on the fundamental shift in soil condition (e.g. change in water quality; greenhouse gas emissions). Understanding these changes without the basic information on soil condition will limit interpretation of these other indicators which are an emergent property of soil, climate and management practices.

Statistical and methodological quality	
Statistically sound/robust methodology, understood bias and uncertainty	• Methods already tested in the scientific literature as a valid approach. Uncertainty has been quantified and previously reported as statistical significant results of a known probability (i.e. 95% or P < 0.05).
Efficient, affordable, secure data collection	• £200k a year currently committed to by CEH which will be reviewed on an ongoing basis. • If the Government is to deliver on its published goal for England's soils to be sustainably managed by 2030 and realise their value, aligned or additional funding is needed to increase sampling depth to 1 m, increase sample size and area coverage for priority land types and / or accelerate the sampling cycle thereby reduce uncertainty; and sample a wider set of indicators e.g. soil contaminants, biodiversity.

The Sustainable Soils Alliance Science Panel **January 2019**