

The following is a “research idea” for the UKRI Strategic Priorities Fund (SPF) drafted following discussions amongst the soil research and policy communities at the

**National Soil Health Policy workshop, 6 February, 2020, UKCEH Lancaster,**

The research idea was jointly submitted to NERC for the UKRI SPF on behalf of the soils community on 10 February, 2020, by representatives from the following organizations:

UK Centre for Ecology and Hydrology, Forest Research,  
British Geological Survey, Cranfield University and James Hutton Institute

(Workshop financial support was provided by the NERC National Capability UKSCAPE SOC-D project)

*The format below follows the requirements of the NERC online submission website. The lines in italics at the beginning of each section list guidance provided by NERC. The length of each section was specified by NERC.*

The submission website is here: <https://nerc.ukri.org/research/portfolio/strategic/ideas-spf/>

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**Title:** Improving Soil Health for Future Generations

**Statement of the idea:**

*A short summary of the idea suitable to be published on the NERC website*

Soil is a basic component of the UK’s living infrastructure & requires nurturing to deliver multiple environmental & societal benefits. Management practices post-WWII have focussed on short-term production exploiting machinery & chemicals with little care for long-term soil health. More sustainable practices are urgently needed which recognise soil’s very slow renewal rate and evidence of long term damage: soil organic carbon (SOC) loss in arable soils since the 70s; over-exploitation of peats; & legacy of contamination (Parliamentary Soil Health Inquiry 2016). Transformative change to more sustainable practices is only possible by understanding the barriers to adoption (disconnect between society & soil; legal & tenure issues encouraging short-term attitude to soil health; lack of independent advice; clear evidence of where, when & why practices may benefit or damage soil). This understanding requires an inter-disciplinary approach that will:

- co-produce with stakeholders a suite of evidence & actions which can inform the policy environment of all four UK nations
- close the gap in the skills base of land managers and provision advisory services
- improve the fundamental UK research and innovation base and enhance uptake of new technologies
- improve the evidence base to enable adaptive management into the future

Success will bring more effective, efficient and engaged decision-making to ensure soil is fit for future needs in the face of climate and societal change.

**Identify why this idea would be appropriate for SPF:**

*Identifying why SPF is the most appropriate method for delivering this idea, for example, how this proposed area links with government departments’ research priorities & opportunities, &/or drives an increase in high-quality multi- & interdisciplinary research & innovation.*

We need to rethink soil health as a concept emerging from societal & cultural values rather than a simple environmental output. Innovative cross-disciplinary research is essential to deliver healthy soils for future generations while sustaining human health and well-being, economic prosperity

and ecosystem functioning. Our history with soil is complex from ‘the killing fields of mud’ of WWI and source of ‘lock-jaw’, to the fundamental attachment of many to ‘our land’, be it farmland or garden. What drives social and cultural change in how soil is valued and used by society? This question requires experts in soil, farming & forestry, conservation, climate & air pollution science, social science, economics, law, cultural history and artists (communicating how society sees soil). The ambition is to harness advances in technology with environmental & social understanding to manage and protect this non-renewable resource for future generations. Soil is part of the common UK heritage and is both public and private good with benefits and dis-benefits that are local and national. Policy and regulatory change is essential to balance the rights of individuals with those of society. This SPF supports environment plans and strategies in the four nations (e.g. the 25YP in England, Wales’ Environment Act, Scottish Land Use Strategy, NI Environment) and also underpins broader policy goals and priorities including net zero climate targets, food security and health and well-being.

### **Outcomes:**

*Description of the impact the research & innovation will have. A brief summary of routes to ensure outcomes including potential stakeholders & partners should be included*

Routes to impact:

- Co-construction of SPF & funded activities for stakeholder needs (science, policy, industry & NGOs)
- Co-creation of networks from national experimental platforms to local & national policy, research & industry initiatives
- Practical tools, advice & evidence supporting trusted intermediaries who interface with land managers, science, and the choices informing & incentivising regulation & policy

Specific outcomes:

1. Increased public awareness of soils; adoption of new practices; expanded engagement & knowledge transfer by stakeholders (industry & levy boards; farmer unions; landowners; NGOs; galleries, museums & libraries)
2. Trusted evidence base of what works, where, when and why, constructed with land owners, industry & researchers for evidence-based actions (as for 1)
3. National network of Soil Resilience Experiments (developed with SMEs using common designs across land use & climate gradients) providing clear new insights into climate change risks & opportunities, a testbed for technological development, and support for future generations of students & practitioners
4. Technological development (e.g. sensors, tools, model & data platforms) underpinning policy needs for tracking market & non-market outcomes (and enforcing regulations to protect soil assets) and connecting land managers with quality assured data empowering them to undertake responsibility & adaptive strategies for handing on better quality soil to the next generation.

### **Research & innovation question(s):**

*A description of any scientific or innovation advances needed, timeliness & novelty. The advances should be well-defined & specific & include relevant citations. They should be appropriate in scale for a SPF programme.*

Questions addressed:

- Why is soil not valued as much as other natural capital assets by policy makers or the public? (‘Cinderella’ of natural environment: 2016 Parliamentary Inquiry)

- How to get people to value (care for) soils, to recognise urgency & risk from unsustainable soil management, to use their purchasing power? Can this be challenged & reversed?
- What are entry points to public opinion: climate change mitigation potential; food security; rich soil biodiversity; untapped potential for bioproducts; community gardens in cities; or....?
- What changes behaviour and encourages uptake of more sustainable practices (policy regulation vs incentives; farmer to farmer; independent and trusted advice and support; 'market pull'; change in taxes, etc.)
- How does behavioural change vary from urban to rural communities; upland to lowland farms; commercial to conservation woodland (and other sectors within these overly simplistic categories)?
- How robust is current evidence to support soil management decisions across the UK (where, when and why) and how does this need to change for future climate scenarios?
- Are there new ways/tools/systems to better monitor outcomes and impacts and are there new indicators of soil health & change we can use to provide early warnings?
- Where are tipping points of soil resilience? Although our soils have to date not shown catastrophic declines (with exception of some landslips) – can we project when and why such tipping points may occur?

### **Capacity:**

*Whether the UK community has the capacity & infrastructure needed to do the research & deliver innovation, including, if applicable, how the research & innovation builds on & complements existing activities &, if appropriate, utilises UKRI infrastructure. Required new capital investments & evidence for training needs should be highlighted in this section.*

### **UK capacity:**

- Energised agricultural & forestry exploring 'sustainability branding' in challenging export markets & highly engaged NGOs (LEAF, Sustain, Soil Association, Sustainable Soils Alliance)
- NERC NC (SOC-D), BBSRC ISPGs & Scottish RESAS programmes
- Major landowners (National Trust) adopting soil improvement plans
- Globally unique observing (COSMOS) & data (UKSO) platforms & Sentinel satellite access
- NERC Soil Security Programme, BBSRC SARISA, STARs CDT & ENVISION DTP shaping new generation of soil scientists.
- This idea will fund National Network of Soil Resilience Experiments (self-funding in 5 yrs) & training of next generation postgraduate students with interdisciplinary skills including social science, data science & EO

### **How the idea originated & has been developed:**

*Including a note of the organisation(s) involved, & how the idea was generated, for instance through workshops. This section should not include any individually identifiable information.*

Developed at the National Soil Health Policy Workshop (6/2/2020, UKCEH Lancaster) exploring how UK can most effectively work together on soil health research & policy issues. Led by 2 reps from 5 research organisations with remits for supporting national soil research & policy needs (UKCEH, BGS, Forest Research, Cranfield Univ., & James Hutton Institute) with invited senior reps from policy partners (Defra, EA, Forestry Commission, Scottish Government, SEPA, Scottish Forestry, Scottish Natural Heritage, Carbon Centre Edinburgh, Welsh Government) plus UKRI. There were 32 participants from 15 organisations with expertise in national-scale soil data &

analyses. Workshop organised & supported by NERC funded UKCEH UKSCAPE SOC-D programme.

**Estimate the percentage relevance to one or more of the following NERC research & innovation priorities as set out in the NERC Delivery Plan 2019 (PDF)** (multiples of 5%, totalling 100%)

Productive environment 30 %

Healthy environment 30 %

Resilient environment 20 %

Digital environment 15 %

Global environment 5 %

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