

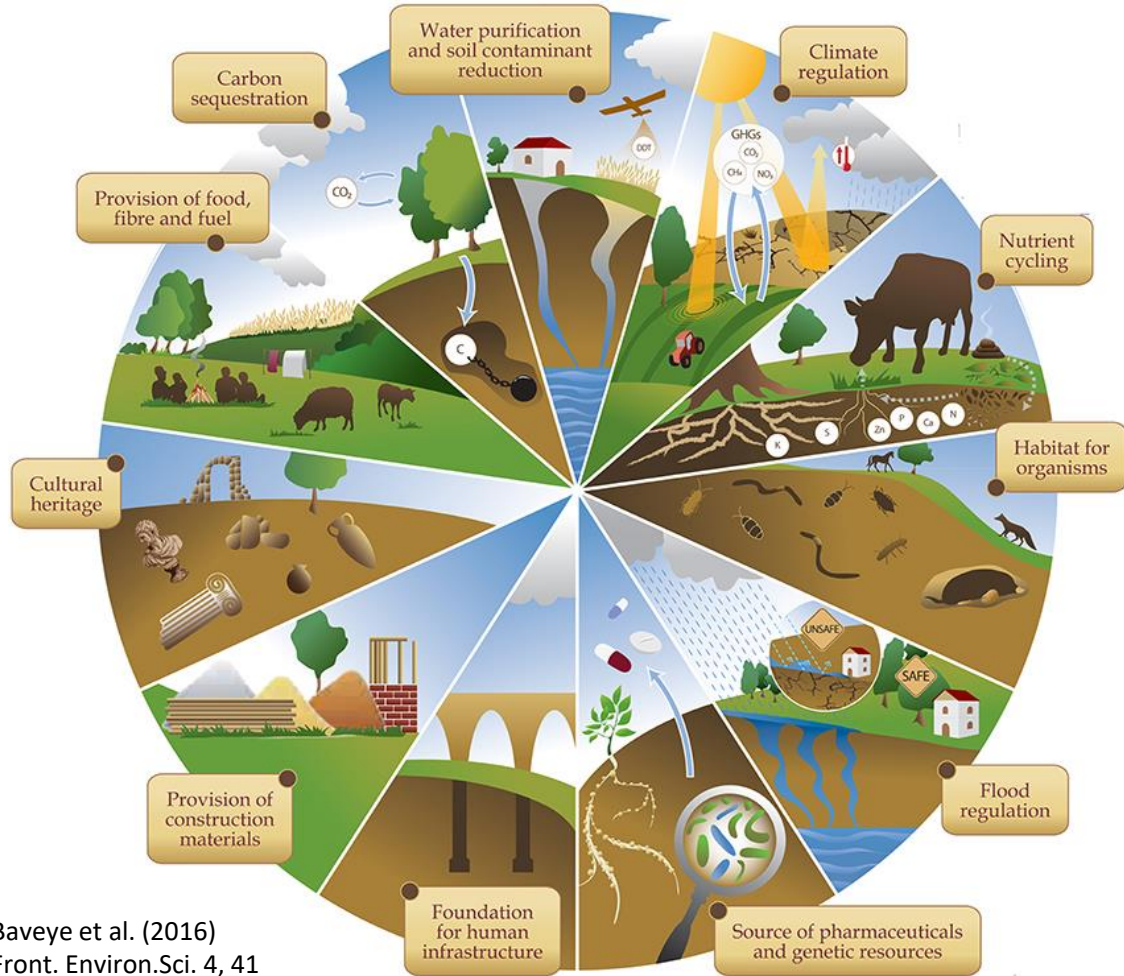


# Soil Health

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**EPIC Launch – September 2019**



# Soil Health

*“the continued capacity of the soil to function as a vital living ecosystem that sustains plants, animals and humans”*

(USDA-NRCS, 2012).

Baveye et al. (2016)  
Front. Environ.Sci. 4, 41

www.defra.gov.uk

## Safeguarding our Soils

A Strategy for England



**defra**  
Department for Environment,  
Food and Rural Affairs

  
HM Government

A Green Future: Our 25 Year Plan to  
Improve the Environment



*“Soils have degraded over the last 200 years due to intensive agricultural production and industrial pollution”*

### **Current threats:**

- Erosion by wind/rain
- Compaction
- Organic matter decline

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*“Soils have degraded over the last 200 years due to intensive agricultural production and industrial pollution”*

### Current threats:

- Erosion by wind/rain
- Compaction
- Organic matter decline

Climate change, accumulation of pollutants, depletion of P reserves, multiple stressors etc. exaggerate this

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*“Soils have degraded over the last 200 years due to intensive agricultural production and industrial pollution”*

### **Current threats:**

- Erosion by wind/rain
- Compaction
- Organic matter decline

*“at the heart”* of government agriculture policy  
(George Eustice – DEFRA minister)

# Ecology and Environmental Microbiology Research Group

**Biodiversity**

**Biogeochemical &  
macronutrient  
cycling**

**Climate &  
Environmental  
Change**

**Environmental  
Biotechnology**



# Local physical and chemical characteristics primarily determine the life and functioning of healthy soils



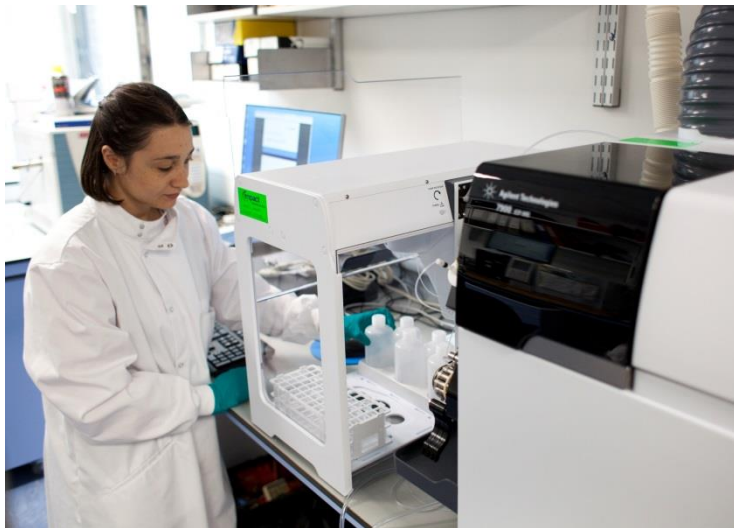


**high  
throughput**

**pH, C, N, P, H<sub>2</sub>O, ρ,  
etc...**

**Anions, cations,  
C/N  
transformations...**





**Metals – e.g.  
Pb, Zn, Cd,  
Cu, Hg, Ni  
etc.**

**Nasties - PHE,  
POPs, PAHs,  
PCBs  
petrochemicals**

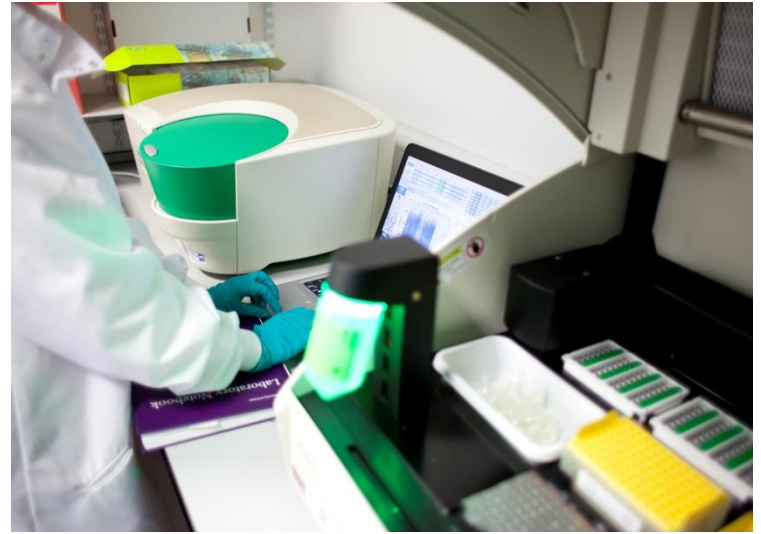
# The biodiversity of healthy soils drives the ecological processes that support soil ecosystem services

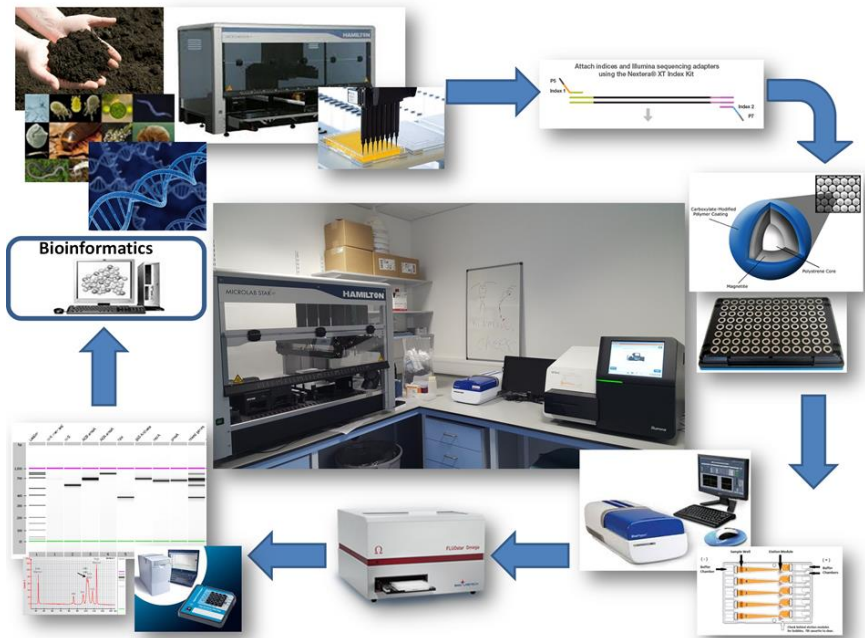




**Ultra high  
throughput**

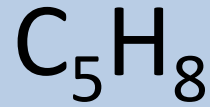






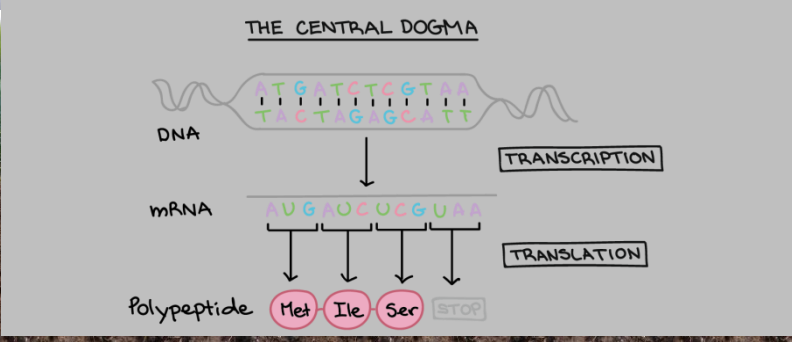
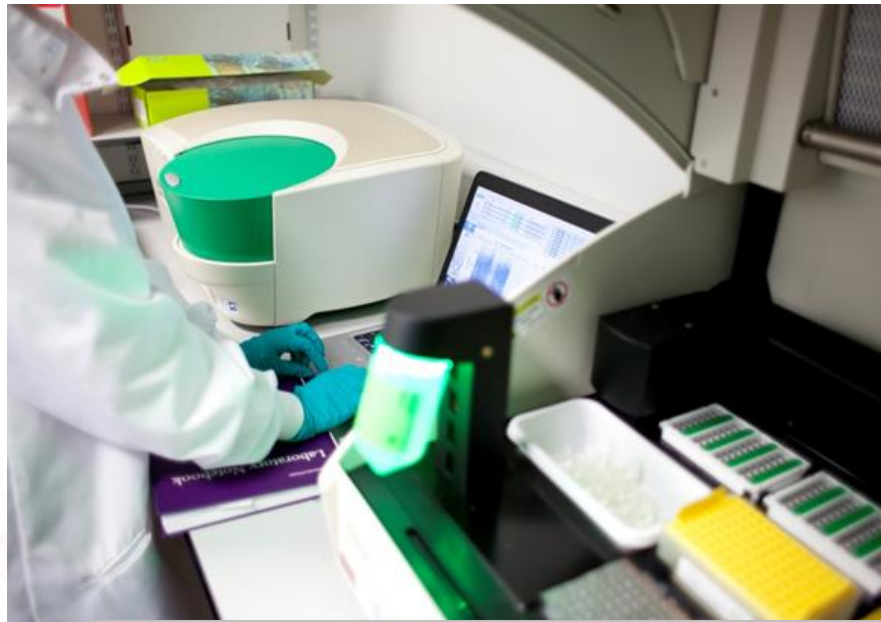
# Ecosystem processes and functions in healthy soils can be quantified





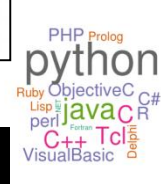
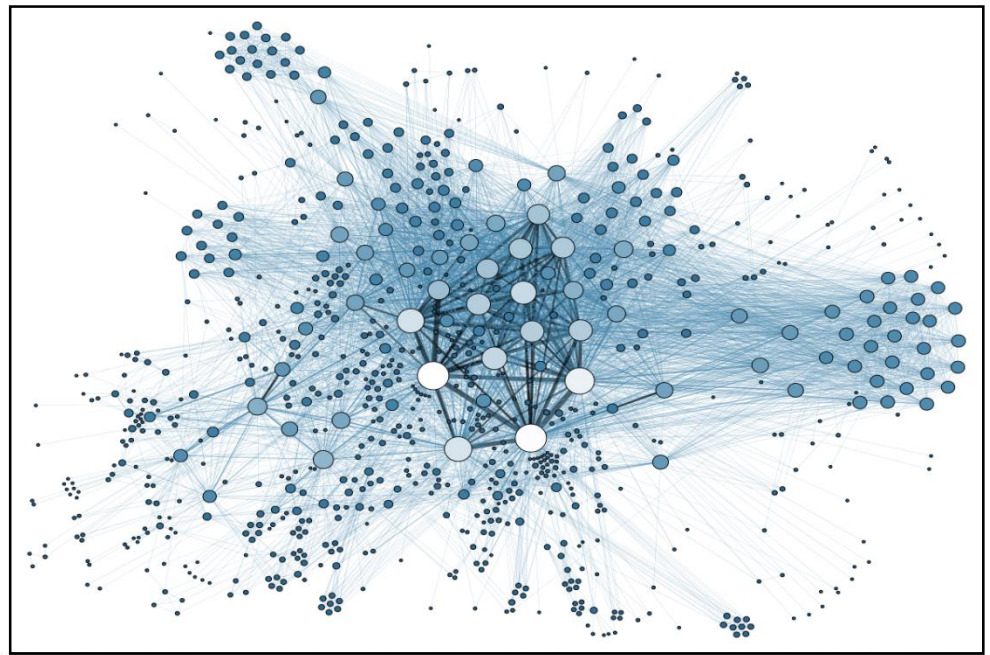
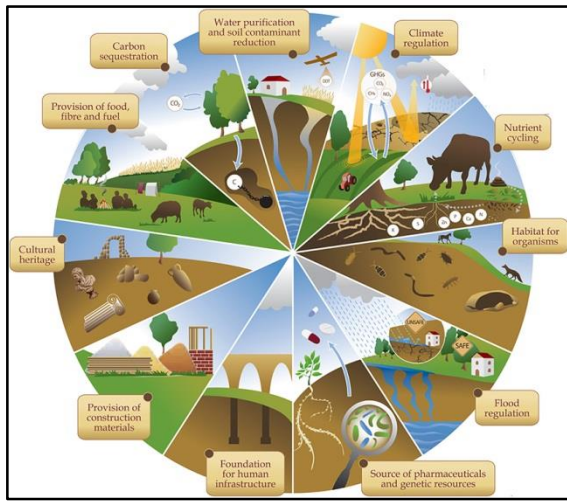






# Linking soil physical and chemical characteristics to soil biodiversity, ecosystem functions and health





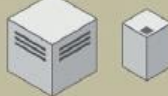
### (A) Automated sampler and sequencing

*Schematic of the key elements of an automated sampler and sequencer to be distributed across a global array of sample points*

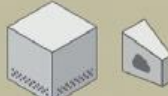
Sample mechanism



DNA extractor and reagents pack



Sequencer and communication pack



Battery/solar pack and processor



### (B) Global array of samplers and in-cloud network reconstruction

*Sequences in all uploaded samples are identified and the implicit interactions reconstructed into networks using machine learning in the cloud*




### (C) Analysis across highly-replicated networks

*Detection of change in network structure, from analysis of variation between networks, across the sample array*



## Next-Generation Global Biomonitoring: Large-scale, Automated Reconstruction of Ecological Networks

Bohan et al. (2017). Trends in Ecology & Evolution, 32, 7



Thank you for listening, any  
questions???