SUSTAINABLE SOILS ALLIANCE

The Soil Maps of England and Wales

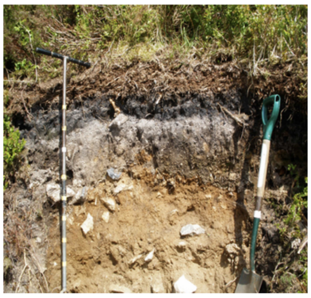
The diversity of soils

Soils are not all the same. Indeed, some experts argue that soil diversity is as pronounced as that which distinguishes different plant and animal species – and should be understood as such. They argue that identifying different soil types and their roles is as important as the distinction between an oak tree and a birch or a seagull and a robin.

Recognising this heterogeneity is particularly important for interpreting and diagnosing problems in our soils. If we apply the analogy above, we wouldn't begin to tackle ash dieback without first identifying an ash tree and knowing its inherent features.

The same approach needs to be taken to soil health and management, starting with an appreciation of the numerous different soils – and where to find them. To date, 747 different soil types – called soil 'series' – have been identified across England and Wales, with varying chemical, biological and physical properties, resiliencies, capabilities and vulnerabilities – the result of their evolution over geological time.

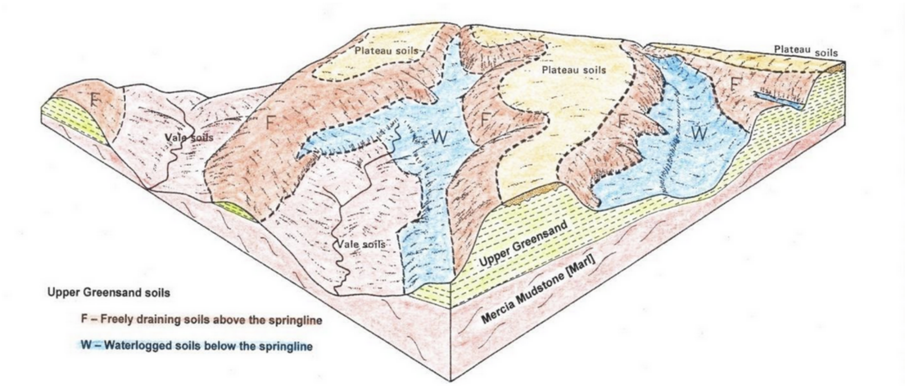
At a more generalised (and manageable) level, these can be sub-categorised according to ten broad groups, as laid out in detail here, which at a glance are Terrestrial raw soils, Raw gley soils, Lithomorphic Soils, Pelosols, Brown soils, Podzolic soils, Surface-water gley soils, Ground-water gley soils, man-made soils, Peat soils.



Profile 1) Clayey, gleyed soil. Profile 2) Loamy, freely draining soil. Profile 3) Podzolic soil under healthy vegetation (photos by Tim Harrod)

The importance of maps

Soil maps are an attempt to organise and represent the distribution of these different types/groups across the Earth's surface. These maps and the data that underpin them provide a key to understanding the complexities around land use and soil-related problems, such as nutrient and pesticide leaching, run-off to rivers and flooding. By the same token, these maps hold the key to the 'solutions', such as crop, tree and habitat suitabilities, groundwater recharge, foundation conditions and water and carbon storage.



Distribution of coloured soil maps in Scotland © James Hutton Institute 2021 (https://maps.nls.uk/series/soils/)

Sub and top-soil
In essence, soil is an ecosystem providing the context for interactions between a myriad of organisms and natural processes. When assessing soil health and quality, much of the focus is naturally on topsoil (being more readily accessible), but this overlooks the very strong influence that sub-soil has on the topsoil (and vice versa), and the type of interacting ecosystems that results.

Digging down through the soil profile reveals some of these hidden influences - geology, the impacts of deep-rooting plants, where water sits and where carbon from the atmosphere is most safely stored. By the same token, topsoil can be bought in a bag and used as a growing medium anywhere – however this does not make it an ecosystem.

The mapping of where one soil type merges into the next, and the associations between them, creates a three-dimensional mosaic of the living processes that underpin life across the landscape.

History of soil mapping
Initiatives to understand and map soils go back as far as the 1600s. In the UK, efforts to classify soils scientifically started in earnest in the 1930s, leading to the publication of local soil maps at 1:63,360 and then 1:25,000 scales. These collectively cover about a quarter of England and Wales.

However, it was not until 1979 that a full national Soil Survey of England and Wales (SSEW) at a 1:250,000 scale was commissioned by the government to support refinement of draft Agricultural Land Classification maps. The maps and data this produced led to the establishment of the national soil map we have today, achieved through a five-year programme that commenced in 1979, at a cost to the public purse of some £6.5m.

At that point, the SSEW had its headquarters at Rothamsted Experimental Station (now Rothamsted Research) with surveyors based at outstations around the country. At its peak, SSEW employed 48 field soil scientists – experts in soil examination, classification, mapping and interpretation.

Recent history
In the late 1980s, funding for the national soil mapping programme ended and the government transferred ownership of the maps and their data to the Cranfield Institute of Technology (now Cranfield University), who continue to host and develop the resource at their Soil and Agrifood Institute.

The cessation of the soil mapping programme has led to a steady decline in the number of experienced soil surveyors and field pedologists, and the national soil survey and field pedology skills base is now a matter of concern.

A detailed history of soil mapping in the UK by Prof Stephen Hallett of Cranfield University can be viewed [here](#) with latest iterations to the maps described [here](#).

Map resources today

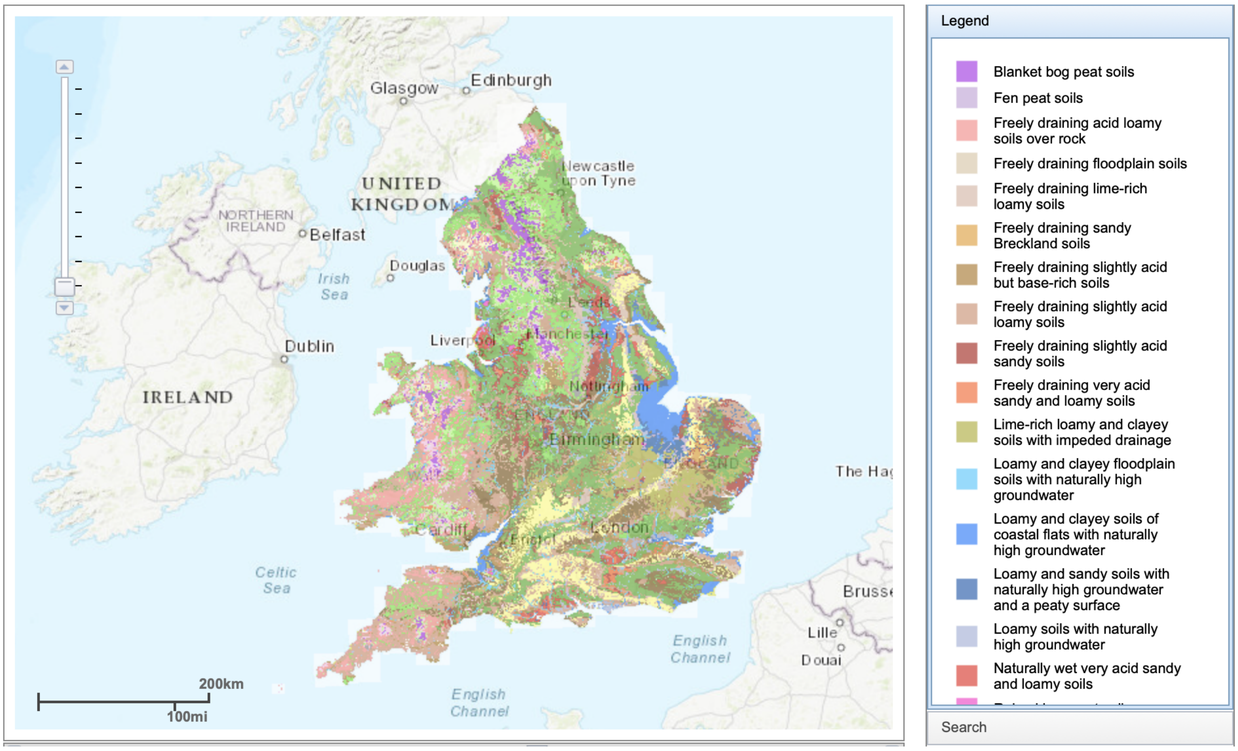
The England and Wales soil information resource held at Cranfield University consists of the following three principal elements:

- [LandIS](#) is the national computerised database system for soil and related land information. LandIS is recognised by the UK Government as the definitive source of national soils information.

- Within LandIS sits the vector dataset NATMAP, which is derived from the [National Soil Map for England and Wales](#). NATMAP is the most detailed national soil mapping dataset of four versions of the National Soil Map.

- [Soilscapes Viewer](#) is a free-to-access online soil map viewer showing the simplified soil dataset of England and Wales at a scale of 1:250,000. It was developed from the NATMAP Vector and communicates a general overview of variations between soil types, and the influence of soil type on the environment and landscape. Soilscapes at 1:250,000 scale is not intended to support detailed assessments, such as land planning applications or site investigations.

There are also many other related datasets within LandIS, such as the 5km grid National Soil Inventory. Behind these digital resources are well organised paper records and a soil sample archive.



Soilscapes Viewer 2021 (http://www.landis.org.uk/soilscapes/)

Licensing arrangements
The maps and their data are available under different [licencing agreements](#) between Cranfield University and individual users for which costs vary. Cranfield has made attempts to make the data more accessible by applying a sliding scale of access and fees.

Intellectual property of the data
Licensing agreements provide access to critical data but can also preclude the release of outputs or products that use the data, either to the public or to delivery bodies. This in turn can prevent the actioning of projects dependent on environmental models.

An illustration of this is the Open Government Licenses (OGLs) which apply to work commissioned by the government, but which do not necessarily allow third party organisations (often contracted by the government in the first place) to use the outputs. By way of example, natural flood risk models created for the government and derived from the mapping data cannot then be used to inform strategies rolled out through delivery bodies such as Local Nature Partnerships, the Rivers Trusts or private contractors.

Improving existing open access maps
Soilscapes is a useful but limited online soil map viewer which has potential for greater use and accessibility. The user interface is rather dated and could be improved. Greater access to downloadable datasets based on Soilscapes and NATMAP is needed and these should be linked to the LandIS information that is currently online. User-friendly guides could also be developed.

There is also scope to develop other open access grouping of datasets based on NATMAP and Soilscapes, for example broad soil groups at risk of erosion, soil structure degradation, compaction and runoff.

Is there a public task for environmental data?
Since the transfer of the maps and their data to private ownership a generation ago, a lot has changed both environmentally and in terms of the nation's response to environmental challenges. Brexit has ushered in a raft of new environmental policy initiatives, many of which have soil at their heart or for which soil is an integral element.

To successfully pursue these initiatives, researchers, policy makers and land managers will need access to every tool available. The soil maps and the data that underpin them are arguably the most critical. For example, to deliver long-term improvement for soils, the Sustainable Farming Incentive (SFI) and Environmental Land Management scheme (ELMs) will need guidance and metrics tailored to different landscapes and soil types. With availability and enhancement such as increased resolution, the soil maps could be used to inform land use planning on the ground, and at a higher level how we model and act upon soil's influence on some of the biggest challenges we face – flooding, drought, climate change, biodiversity loss and food security.

Clearly there is a balance to be struck when it comes to the licensing of environmental data. On the one hand, there is a strong argument that restricted access stifles innovation, limits knowledge transfer and learning, inhibits a fuller understanding of the natural environment by those who manage it, and hinders collaboration in solutions to pressing environmental problems. On the other hand, there is a significant cost associated with gathering, hosting, and maintaining such data.

Addressing this challenge in a way that is fair and equitable must be at the heart of any initiatives to bring the soils data and maps of England into the 21st Century, so they can take their place as the tool underpinning advice and practice on the sustainable use and management of soil that they were designed and commissioned to be.

Fulfilling the soil maps' potential?

In August 2021, Defra commissioned the SSA to help explore how England's soil maps can better support the delivery of environmental policies and national commitments. This work will seek the views of policy makers, experts and practitioners to discuss the use of the existing soil data and maps as well as the potential for developing and updating the maps through new technologies such as earth observation.

Through extensive consultation and the provision of case studies by creators and users of the maps, we hope to paint a picture for the government of what the soils community would like to achieve both for and with this resource, and what developments are needed to enable it to fulfil its potential.

Increasing the resolution of the maps and making them more accessible are not the only options on the table. Wales, for example, has both increased resolution and created links through to Agricultural Land Classification. Scotland has made all their soils data freely available online. Other illustrations were given of the type of improvement that could enhance usefulness and foster innovation and collaboration. One such example was by the Rivers Trust: they described areas where the soil maps showed freely draining soils, but their own heat maps revealed standing water across the same area. They deduced through overlaying this data and ground truthing, that poor soil health was not allowing these soils to perform according to their natural characteristics. The Rivers Trust ambition would be for an interactive platform where practitioners and scientists could feed in real time data to inform the targeting of soil health remediation.

The current SSA-Defra project could form the basis for a full review of the soil maps of England. At the SSA, we hope this will be the first step towards enabling England's soil maps resource to fully support the journey towards sustainably managed soils throughout the country.

Ellen Fay, Director of Sustainable Soils Alliance (October 2021)