

## Climate change: be part of the solution Focus on: soil management

Soils are highly variable due to differences in local geology, topography, climate, vegetation and management over thousands of years. Good soil management will improve soil quality and structure, supporting better yields, while also providing a range of wider environmental benefits for your farm. It can also lead to better nutrient management, enabling the optimisation of inputs and potentially reducing production costs. Soil has the potential to be an effective regulator of climate change by storing carbon and therefore reducing losses of carbon to the atmosphere. Taking action now to improve soils makes good business sense and will help maintain productivity and reduce risks and costs in the future.

### DID YOU KNOW?

- Topsoil is the most productive component of any soil series and it can take more than 150 years for 1cm of topsoil to form.
- In some cases good soil management could save you up to £320/hectare, a simple soil structural assessment could save you up to £200/hectare for some winter crops and the use of cover crops to reduce soil erosion could save you £10/hectare.<sup>1</sup>
- Min-till cultivation has demonstrated savings on some farms of up to £80/hectare/year compared to conventional practices.<sup>2</sup>
- It costs Local Authorities up to £30m/year to deal with the effects of soil erosion on roads and footpaths and water companies £55m/year in decontaminating drinking water of soils and phosphates.

### KEY SOIL RISKS FROM CLIMATE CHANGE

- Increased intensity of wind or rainfall may erode topsoil and remove nutrients, which end up in watercourses and release more greenhouse gases into the atmosphere.
- Less summer rainfall will increase drought risk, affecting soil stability and structure.
- Lower soil moisture in early autumn could reduce germination in some crops.
- More days with saturated soil in winter and early spring can damage crop roots and increase risk of compaction, causing surface run-off.
- Increased variability in the number and timing of machinery work days affecting harvest.
- Increased vulnerability of peaty soils to erosion due to lower soil moisture.

<sup>1</sup> England Catchment Sensitive Farming delivery initiative: Farm business benefits, case study 2

<sup>2</sup> Environment Agency (2005), Assessment of 'Win Win' case studies of resource management in agriculture



## ADAPTING SOILS TO THE IMPACTS OF CLIMATE CHANGE

In a changing and more variable climate, good soil management will become a key part of good business. Planting the right crops on the right land/soil is essential to getting the best yields but the impacts of climate change will mean farm businesses need to understand how soils work under different conditions.

The UK is likely to experience hotter and drier summers as well as warmer and wetter winters, which will affect soil structure and quality. Extreme weather events will also increase in frequency and intensity, with direct impacts on soil.

### WHAT CAN YOU DO?

#### Adapting to warmer and drier summers

- Check compaction levels before sowing and remediate using a sub-soiler set just below the compacted layer. This will improve plant access to soil water by ensuring that root growth is not restricted.
- Regular additions of organic matter, by using leys, crop residues, manures, compost, etc., will optimise the amount of water available to plants in the top soil especially on sandy and clay soils.
- Identify soils at particular risk of drought and plan cropping accordingly – sandy soils with no groundwater available in summer are particularly susceptible.
- Reduce wind erosion by planting shelterbelts and consider use of min-tillage techniques to preserve organic matter levels if practical for the crop.
- Where a fresh seedbed is required, aim for as coarse a seedbed as practical for the crop to

help stabilise the soil. Consider winter cover crops to take up nitrogen and nurse crops such as barley with sugar beet to help protect vulnerable soils from wind erosion.

#### Adapting to warmer and wetter winters

- Reduce the length of time bare soil is exposed, especially sandy and loamy soils by ensuring ground cover with productive grass or crops. Leave “weedy” stubbles overwinter.
- Consider using GPS to help reduce the need for designated tramlines. Woodland buffer strips may also help to protect water courses.
- Avoid cultivating wet soil and travelling on tramlines in wet conditions as the compaction caused contributes to much of the run-off from fields.
- Make regular additions of organic matter to soil such as crop residues and manures to increase structural stability.
- Reduce compaction and impact from wheelings by ensuring machinery and trailer tyre pressures are set to operator guidelines. Consider using low ground pressure tyres and for larger machines such as harvesting equipment, tracked units.
- Promote infiltration of water and reduce slumping and capping in susceptible soils by increasing soil stability. This can be achieved by ensuring the land is not over cultivated and that organic matter levels are maintained.
- Improve grazing management to minimise soil compaction and poaching. Locate supplementary feeders carefully and move regularly, consider fencing against streams to prevent grazing animals eroding soil into the water





- Try to capture run-off from fields and tracks into swales or sediment ponds.
- Make use of extended growing seasons by including cover crops to improve soil structure and reduce nitrate leaching. Cover crops such as rye, and legumes such as red clover and vetch fix nitrogen, which when ploughed in may reduce requirements for nitrogen fertiliser in the following crop. However legumes can also be a source of nitrate leaching. Consider your cover crops carefully so that establishment of subsequent crops is not compromised.
- Minimise cultivation damage by visually checking the condition of the soil before and during operations. The greatest risk of structural damage occurs when cultivation is carried out too soon on a drying soil – this may be a waste of diesel.
- Soil structure is prone to damage by most forms of cultivation; consider soil cultivation techniques used throughout the rotation. Where appropriate, consider min-till or no-till which also reduce fuel consumption during cultivation, reducing emissions and saving money.

### Adapting to more extreme events

- Plan field and cropping layout to reduce risks of erosion and retain sediment. For example, avoid gateways at the bottom of fields, plough and align tramlines across slopes where possible, and leave buffer strips and hedges as protective barriers if appropriate.
- Develop a run-off management plan considering soil type, topography and hydrology e.g. by integrating storage ponds in some areas with improved drainage capacity in others.
- Improve field drainage where appropriate, e.g. by sub-soiling to maintain and improve drainage systems, taking into consideration seasonality and risks of diffuse water pollution.
- On soils with very poor structural stability, consider moving towards ley-arable rotations.



## HOW CAN SOIL MANAGEMENT HELP MITIGATE CLIMATE CHANGE?

Good soil management can help to regulate emissions of three key greenhouse gases (carbon dioxide, methane and nitrous oxide) from agriculture, which contribute to climate change. The science behind the role of soil management in reducing greenhouse gas emissions is still relatively young and the relationship between carbon and nitrogen in the soil is complex. More understanding is needed to fine tune practices further. Following existing features of good agricultural practice is generally still advantageous due to the wider production and environmental benefits gained.

- Adding nitrate to soils, whether in fertiliser or mineralised organic matter, increases the likelihood of nitrous oxide release. The risks of nitrous oxide release are greatest in wet, warm and clay or compacted soils, and where levels of decomposable organic matter are high. Reducing compaction will improve nutrient uptake in the soil and help reduce the release of nitrous oxide.
- Efficient nitrogen management can reduce nitrous oxide emissions – by meeting crop requirements and minimising residual nitrogen. Use a recognised nutrient management plan and follow fertiliser recommendations.
- Reducing the intensity and frequency of disturbance will help protect soil carbon sinks. Consider reduced cultivation techniques where appropriate or moving towards a ley-arable rotation on sandy soils.
- Reduce cultivation and/or drainage of peaty soils as much as possible, as emissions increase markedly compared to similar operations on mineral soils.
- Carbon storage (sequestration) in soils under most forms of agricultural management is limited, but farmers can potentially improve and maintain organic matter in soils (and their carbon storage capacity) by regular addition of crop residues and manures or organic materials such as compost and digestate.
- Conserve and maintain uncultivated areas (woodlands, permanent grasslands, buffer strips) within arable landscapes as soil carbon sinks (peat land habitats are particularly vulnerable).

## FIND OUT MORE

Climate change will have different impacts depending on region and different farming types – find out more about projected change in your region on the [UK Climate Projections website](#).

Soil improvements often take some time to be realised, so taking action now will help reduce cost and risk in the future. Maintaining and increasing soil organic matter levels now, alongside improvements in soil structure are also likely to support increased efficiency, reduced costs and equipment wear during cultivation.

- See the [Farming Futures case studies section](#) on how other farmers are already improving their soil management.
- Visit the [AHRF Soil Information Gateway](#) a web resource with case studies on best practice soil management and signposting to further soil information.
- Visit the [SOWAP \(Soil & Water Protection\)](#) website for advice on soil management.
- Contact the [UK Soil Management Initiative \(SMI\)](#) for information on improving soil quality.
- The [Sustainable Organic Resources Partnership \(SORP\)](#) provides information on recycling organic resources and Codes of Practice.

- Contact your regional [Catchment Sensitive Farming Initiative](#) representative to find out about funding for better soil management practices.
- The [Environment Agency Soils pages](#) provide details of priorities for soil management and regulation. Call 08708 506 506 to request the 'thinksoils' manual for advice on saving money, increasing yields, protecting soil, crops and livestock and attracting funding. Or download the '[Best Farming Practices](#)' Guide to find out more about how to reduce costs and impact the environment less.
- Find out more about increasing profits through good soil management from the [Soil Organic Matter Project](#).
- Find out how much carbon you might be emitting, and storing on your land, using the [CLA's CALM calculator](#).
- Find out about Defra's vision for the sustainable management of soils in the [Soil Strategy for England](#).
- Find out more about how GPS technology can reduce soil compaction by visiting the [HGCA 'Be Precise'](#) pages.
- Read [Farming Futures Fact Sheet 18: Focus on water management](#)



# FARMING FUTURES

For news, events, and links to stories about how other farmers are managing climate change on their farms, please visit: [www.farmingfutures.org.uk](http://www.farmingfutures.org.uk)

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