

Cashing in on carbon



Jenni Dungait

FCCT The Soil Carbon Project Workshop

February 2019



**Farm
Carbon
Cutting
Toolkit**

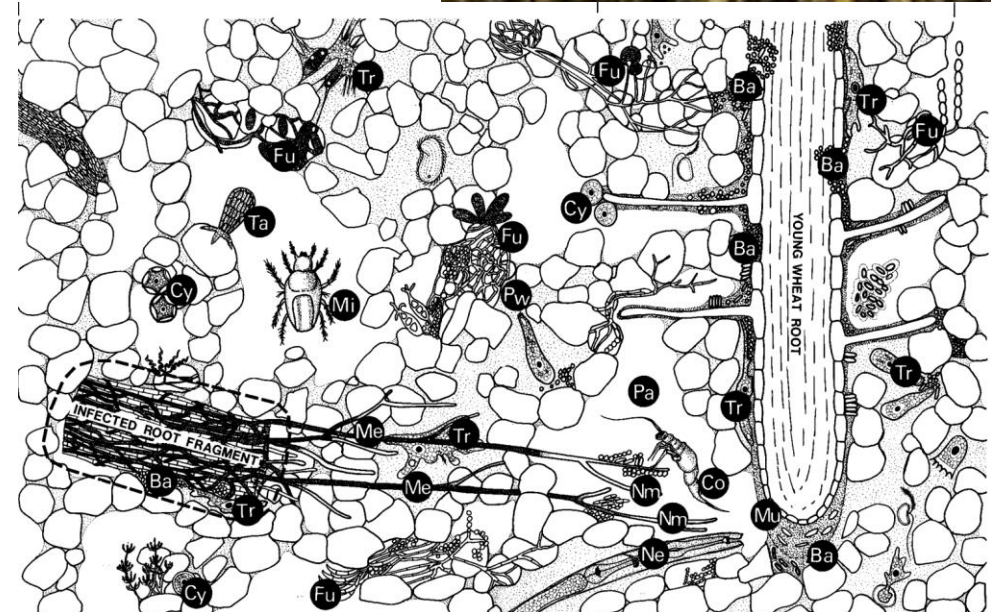
What is soil organic carbon?

Decomposing plants

‘the energy of the sun flowing through your soil’

60% of soil organic matter

- 5% of soil organic matter is alive (soil biology)
- Underground industry supporting the sustainability of your farm



Making money from soil organic carbon

- Payment for increasing soil organic carbon
- Increasing yields and quality by increasing soil organic carbon
- How to prove that soil organic carbon is increasing.



Dirt: where food begins

We rely on soils to grow most of the food we eat.

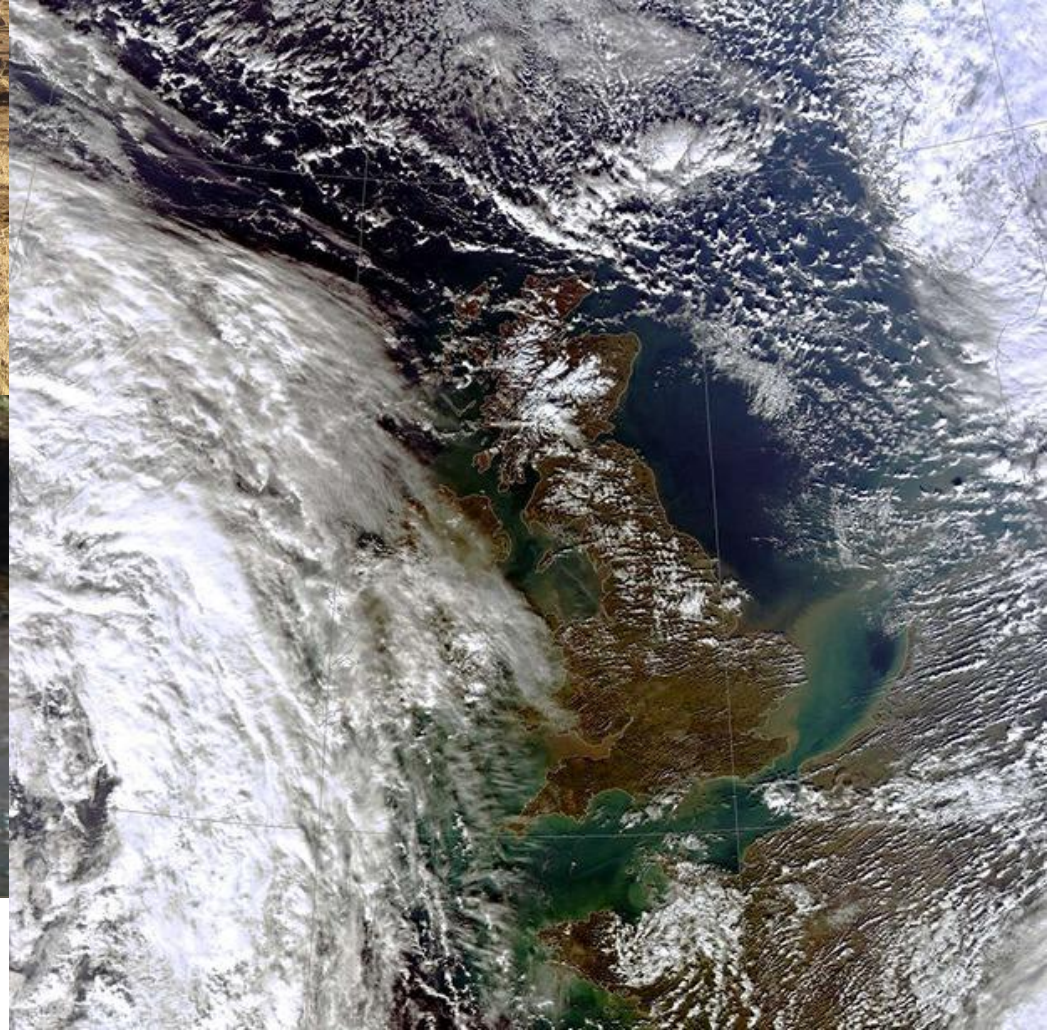
Soil is a non-renewable resource.

Globally, 40% of soil suitable for agriculture is degraded by unsustainable farming methods.

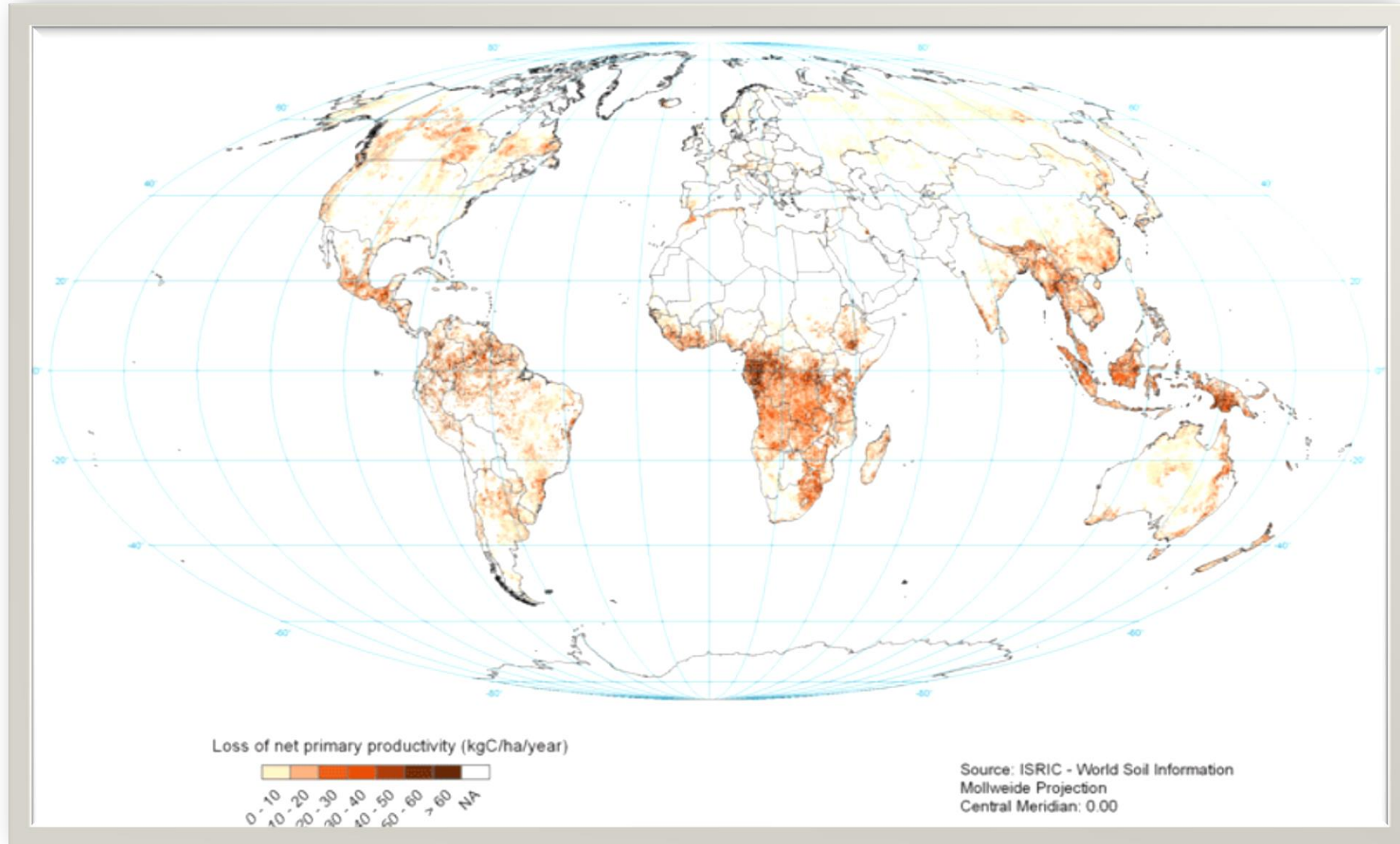
Competition for land – energy production, urbanisation, mining.



Soil sickness



Unhealthy soil causes reduced yields



Future-proofing your soils

- Building soil resilience is at the heart of emerging UK policy
- Soils (with air, water and biodiversity) are considered as part of the UK's asset base, i.e. Natural Capital
- Reduced emissions from soils are key
 - CO₂ - paying farmers to increase organic matter in soils
 - N₂O, NH₄ and NO₃ - reducing N pollution from livestock and N fertiliser applications
 - CH₄ – reducing emissions from livestock by reducing stocks, genetic selection and diet
- Nutritional quality of food
 - focus on 'hidden hunger' from micronutrient deficiencies





Farm soil subsidies

Sir, There has been considerable discussion of the opportunity to improve agri-environment schemes after Brexit. One attractive idea is payment for outcomes that have public benefit, rather than subsidies based on land area. Soil protection is one area where such monies can be wisely spent. In addition to food production, soils provide many environmental benefits, including flood protection, recycling of nutrients, water purification and climate regulation. These benefits are hampered by the continuing loss of soil carbon as described in the parliamentary soil health inquiry in 2016.

If such a payment is accepted, the issue then becomes what indicator we use to determine soil improvement. During the soil health inquiry, soil organic carbon content was identified as the indicator of soil quality that the scientists agreed on. We also concur that soil organic carbon content should be the measure of choice, and that maintaining or increasing this vital driver of soil health should be financially rewarded.

This would benefit farmers' productivity and enhance the environmental benefits provided by soils to the wider community. PROFESSOR LIZ BAGGS; PROFESSOR STEVE BANWART; PROFESSOR RICHARD BARDGETT; PROFESSOR GARY BENDING; PROFESSOR COLIN CAMPBELL; PROFESSOR CHRIS COLLINS; PROFESSOR TIM DANIELL; PROFESSOR LORNA DAWSON; PROFESSOR JENNIFER DUNGAIT; PROFESSOR BRIDGET EMMETT; PROFESSOR KEITH GOULDING; PROFESSOR PETER GREGORY; Plus a further 20 professors of soil science at thetimes.co.uk/letters

Paying farmers for soil organic carbon



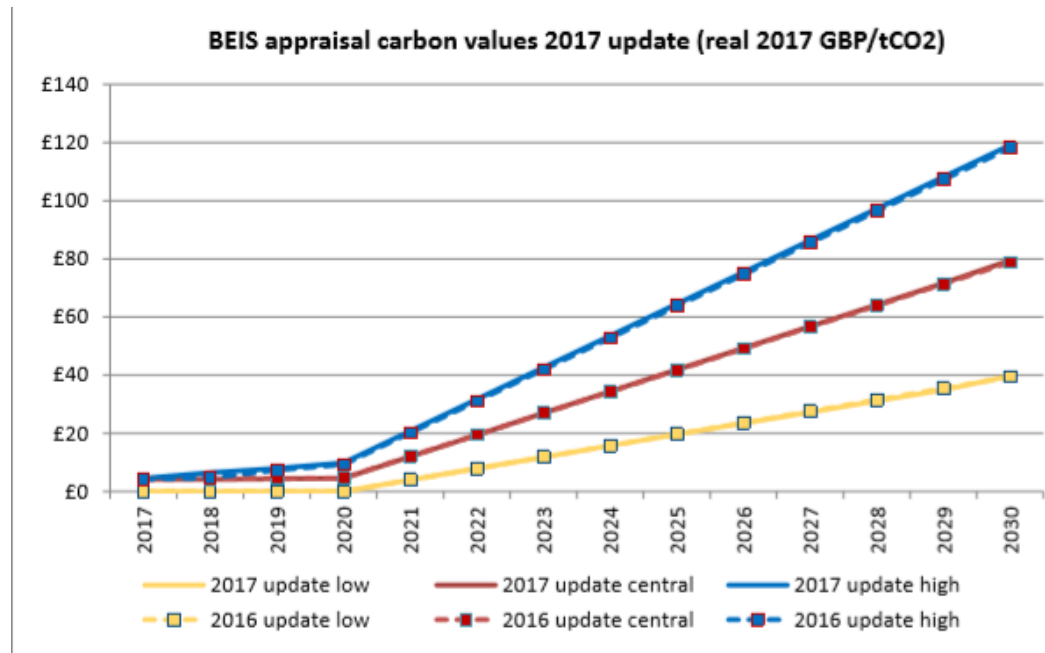
Jennifer Dungait @soilhealthexp · Jan 3

Michael Gove says 'Farmers should be rewarded for organic content of soils.' Hurray! #ORFC19 #soilhealth @MikeGreenSustAg @Luppod61 @sectormentor @ADB0806 @

10

14

36



Who will pay?

- Polluters/off-setters
- Governments
- Insurance companies
- Consumers

Soil organic carbon increases yields

CROP YIELD INCREASES ACROSS CHINA

Straw residue incorporation at a rate of 3 t C / ha / yr with mineral fertilizer application at 200–400 kg N ha⁻¹ yr⁻¹ was demonstrated to be the best farming practice

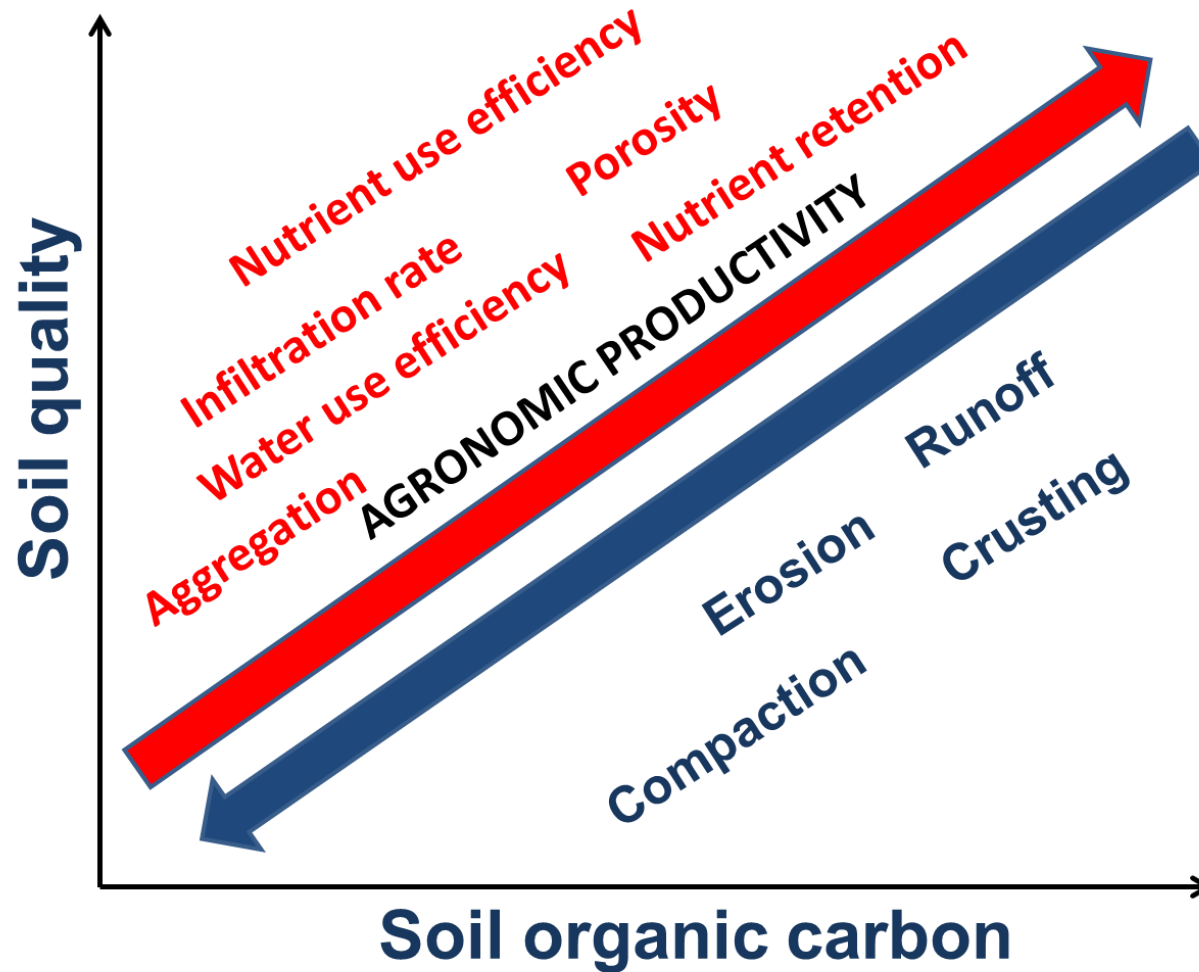
- crop yield increased by average **33 %** (range 18 – 56%)
- soil organic carbon stocks increased at the average rate of **0.85 t C / ha / yr**

INCREASE IN LIVELWEIGHT GAIN OF CATTLE AND SHEEP IN THE UK

Increased soil organic carbon is associated with a better animal performance and less nutrient losses into watercourses,

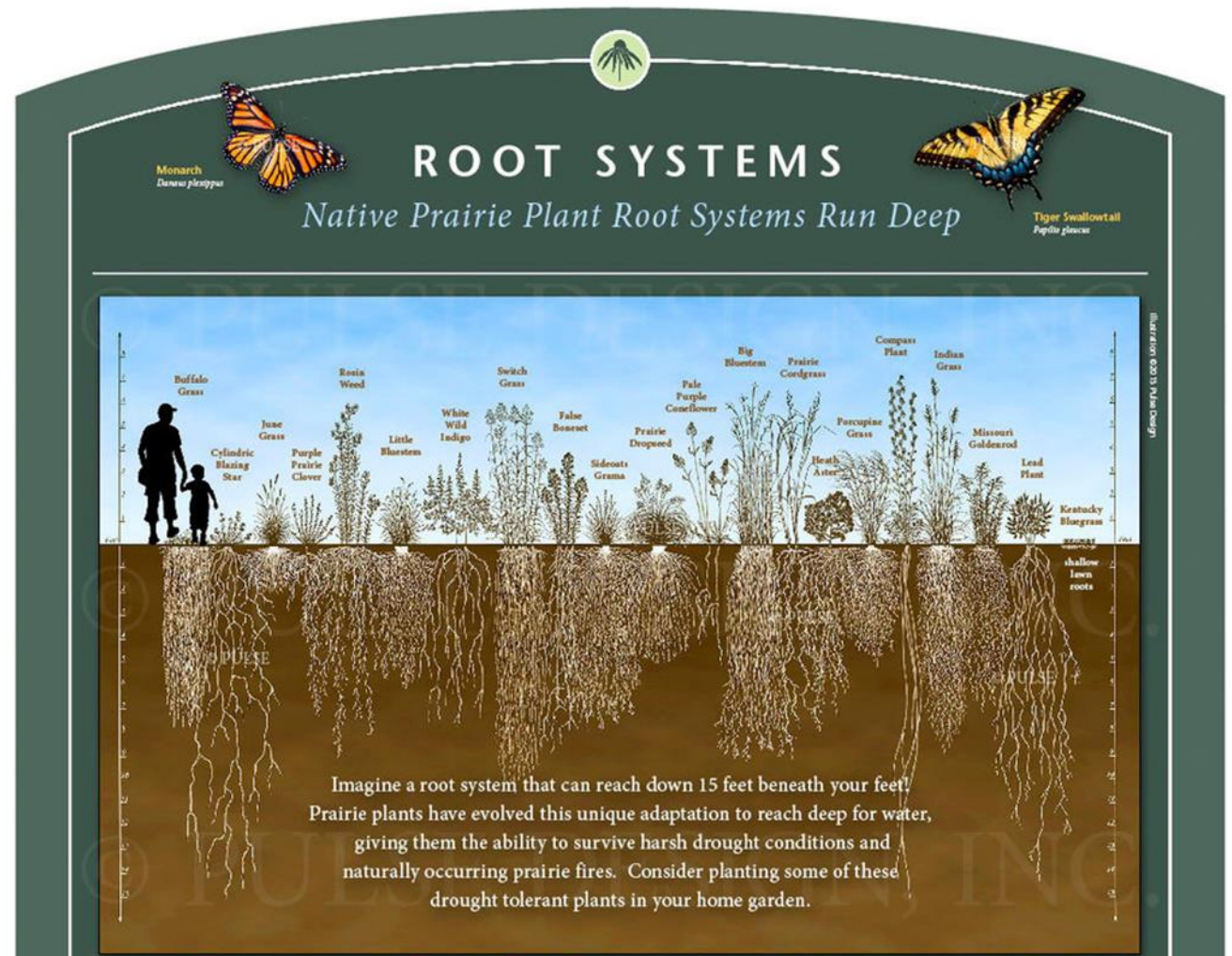
Increased stocking densities if greater botanical diversity and elevated soil organic carbon

How soil organic carbon increases yields



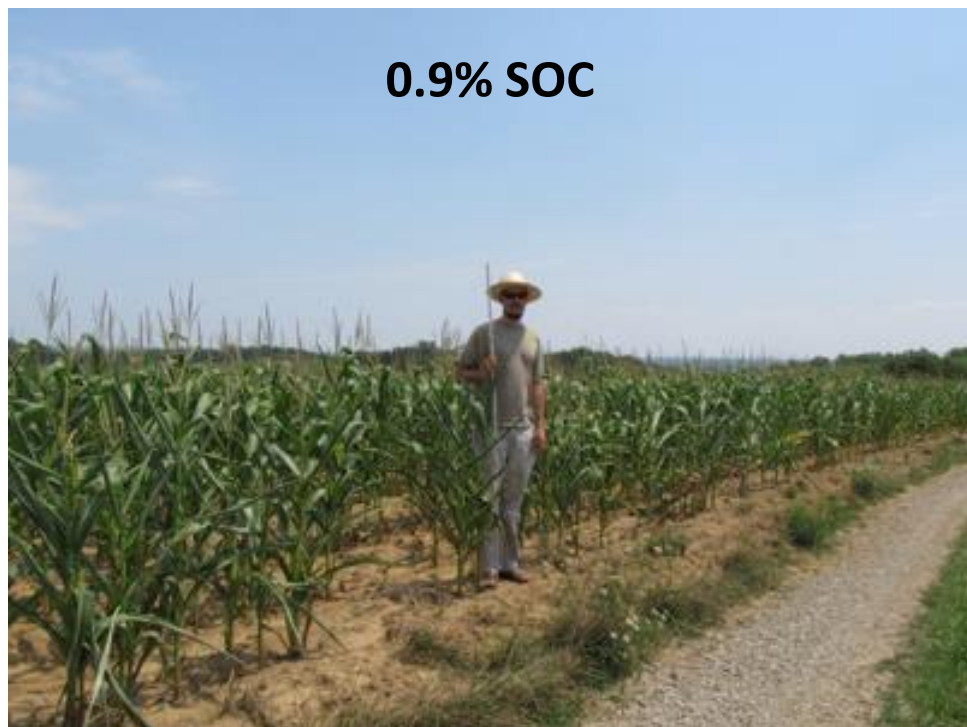
Methods to increase soil organic carbon

- Reduce tillage
- Return all residues and manures to soil
- Cover crops
- Prevent losses by erosion and run-off
- Encourage deeper rooting



Protection from drought: Ohio, USA, 2012

Conventional tillage



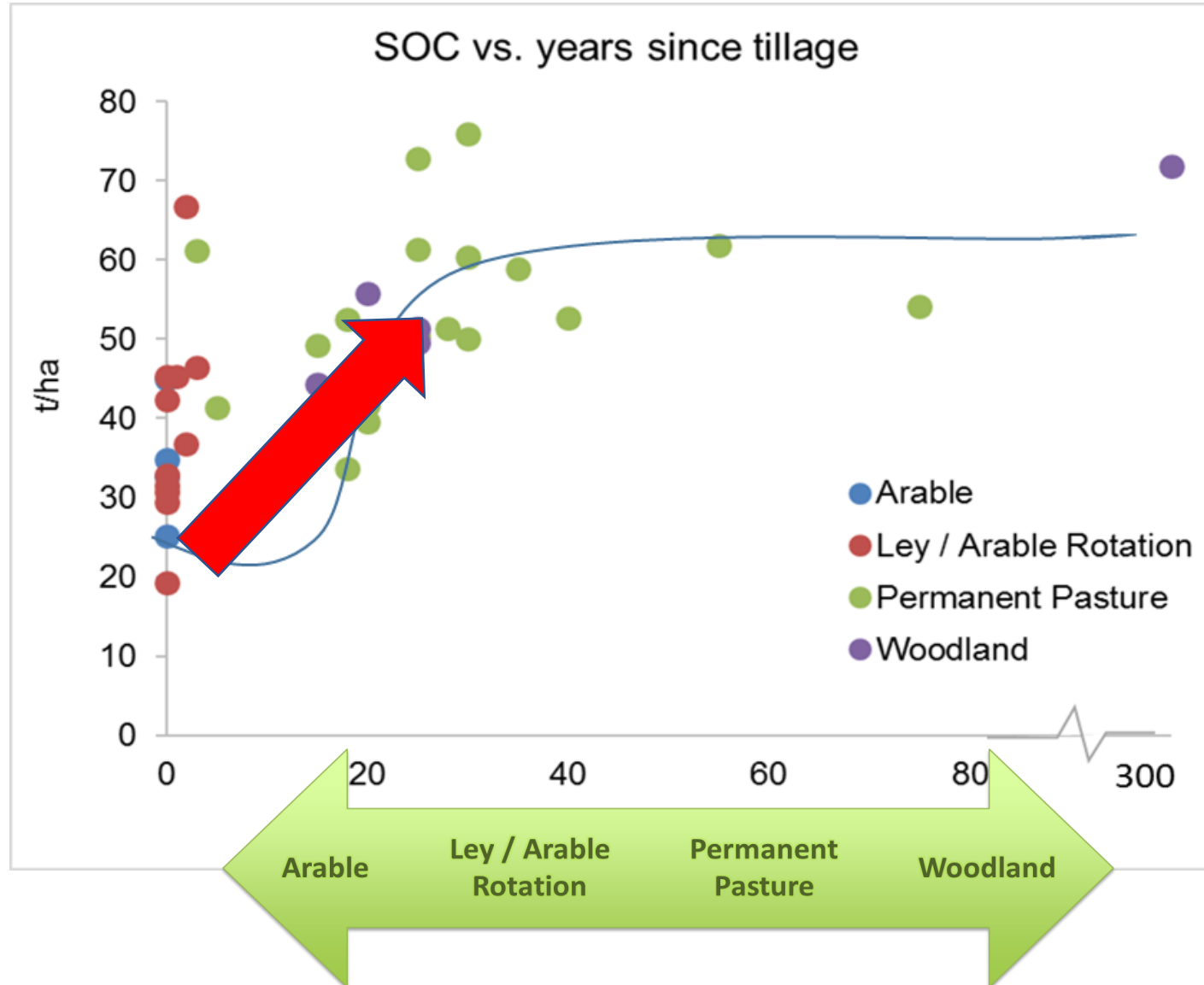
Conservation tillage



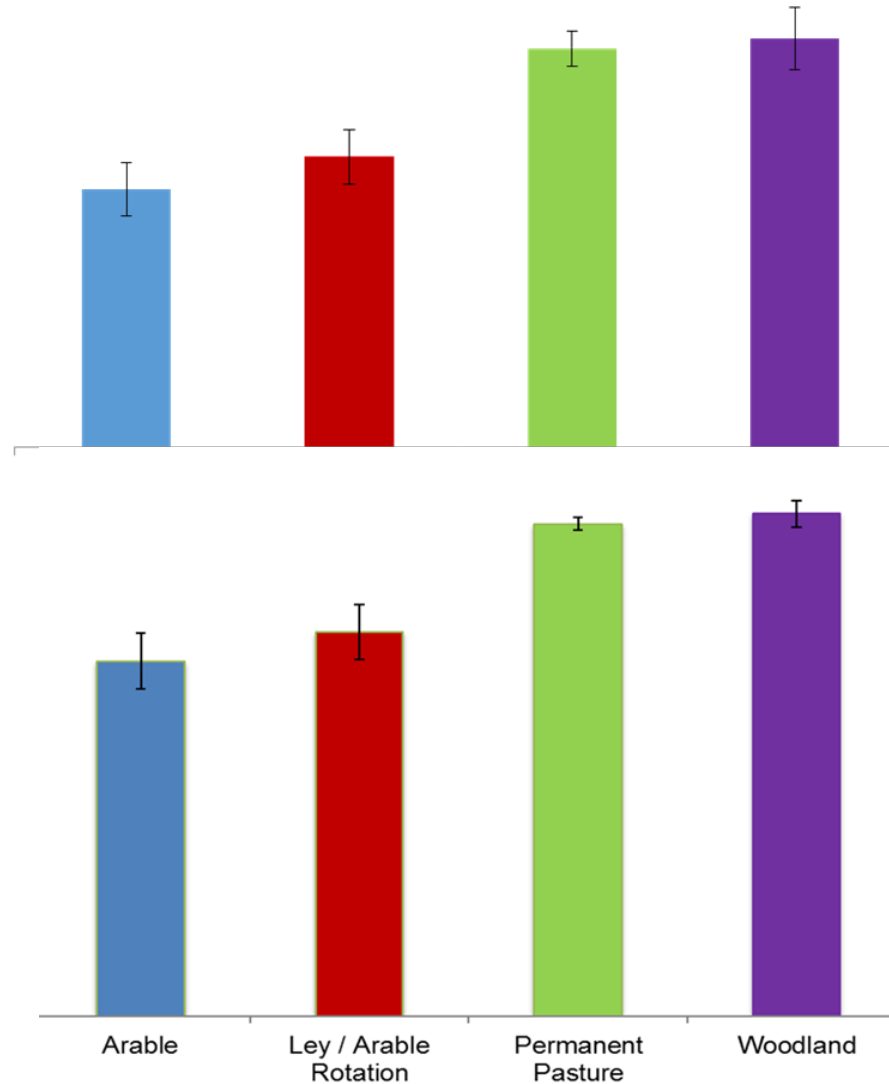
Can you measure soil organic carbon on-farm?



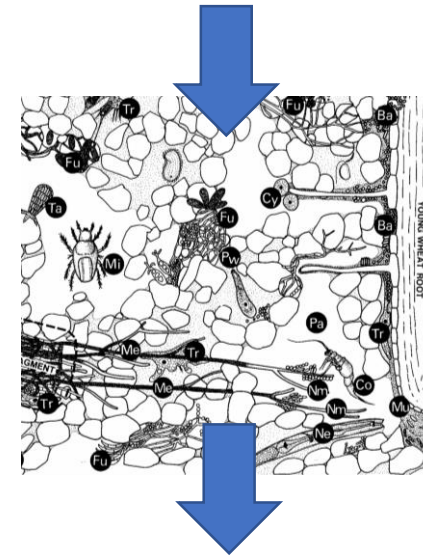
Tamar Valley
Organic
Group
(Biology)



Reduced tillage increases soil health



Soil organic matter



Aggregate
stability in water

Soil aggregate stability is best test for soil organic carbon

Soils with good physical structure are generally associated with larger soil organic carbon contents.

A constant supply of soil organic carbon is needed for aggregate formation and stability.

Stable aggregates indicate the level of soil organic carbon in farm soils

Farmers rated the slake test and earthworm counts as the top 2 methods at the PFLA AGM in 2017.

Full report available on-line



Grassland soil (high %SOC)

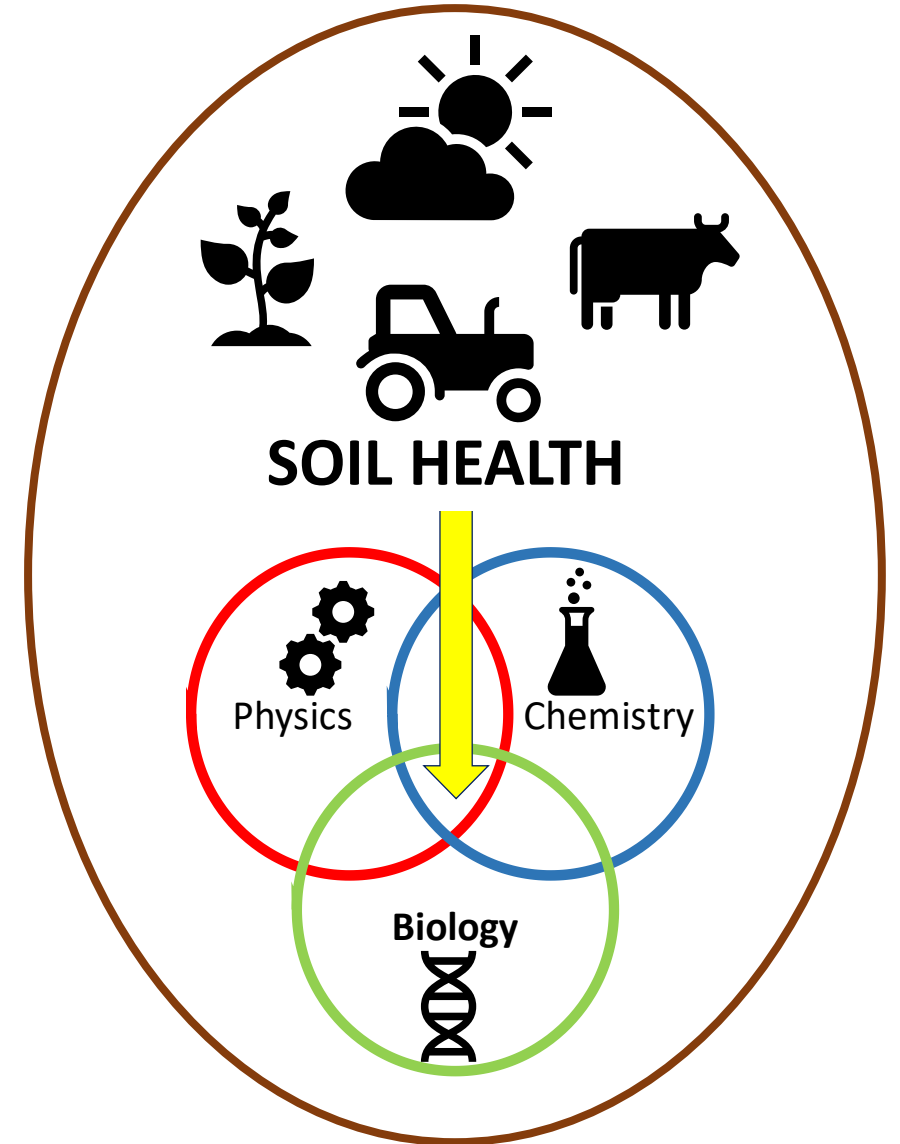


Arable soil (low %SOC)

Summary

SOIL ORGANIC CARBON

- The sun's energy driving the health of the soil system
- Get ready for carbon credits
- Increasing soil organic carbon improves crop and livestock yields
- Soil organic can be measured directly and indirectly on-farm



Soil organic carbon toolkit

- Download the British Geological Society 'MySoil' app
- Get your spade out!
- Do some soil health tests
- Record change over time – input data in FCCT

THE BEATING HEART OF SUSTAINABLE FARMING

What is soil health—and how can you improve it on your farm? Jennifer Dungait offers some practical advice

The idea of soil health is a relatively new scientific concept in modern farming. It differs from the concept of soil quality, because it recognizes the key role of managing soil biology, as well as soil chemistry both as an input and indicator of soil health. The impact of tillage, to achieve more sustainable farming systems, is a soil biogeochemical and chemical process. It is a soil biogeochemical and chemical process. It is a soil biogeochemical and chemical process. It is a soil biogeochemical and chemical process.

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SIMPLE TESTS TO ASSESS THE HEALTH OF YOUR SOIL
Digging soil gives you an insight into the first step in learning about your soils and finding out what you can do to improve soil health, while comparing soils in different fields across your farm will give you an even better picture. You may find that fields you thought were similar are very different when you dig below the surface. But there are a number of simple tests you can do to get to know your soil even better. Before you start any of these tests, note the weather and make sure you are comparing soil with the same soil from the same team through to day. If you are not sure of your soil type, a number of online guides are available to see the way no-till soils have gone in agricultural systems. Try to choose sites that are flat and well away from boundaries and trees that could affect the general character of your soil. Finally, it would also be useful to know the soil's pH and a simple off-the-shelf pH or a suitable service, as this can affect the results you get. You can do the following tests singly, but you will get the most from your soil by doing the more you can with it.



Soil temperature
All you need for this test is a selection of aggregates from soils across your farm where you think the soil organic matter is different. Some is important to compare and some soil water. First, take your soil to a dry place (ideally during hot weather or you can dry it in your oven at a low temperature of 24 hours). If you're using a soil moisture meter, take some soil from your fingers. Next, choose some aggregates of a similar size (say 1cm diameter) and drop them into the water. Watch them to see how quickly they disintegrate. If you're using a soil moisture meter, you can test the same soil after a change in management to see if it has made a difference to soil aggregate stability.



Soil moisture
If you soil aggregate stability test, you'll know that soil is generally more stable in soil organic matter, and will do the same when it rains, breaking up quickly before it can drain away. The longer soil takes to disintegrate in this test, the more soil organic matter it contains. So, when thinking about how to improve the health and management of your soils, remember that you need a constant supply of soil organic matter to help to keep producing the moisture you and your crops need. If you're using a soil moisture meter, you can test the same soil after a change in management to see if it has made a difference to soil aggregate stability.

This test is based on the evidence that soil with good soil organic matter content holds more water, which the ground surface allows some to move down into the soil profile. This means the right conditions for growing crops, because your crops have a store of water when the weather is dry. The water moves through the soil through pores that exist between soil particles and through larger soil pores between soil particles. Take a short section of 10cm pipe and push it a couple of inches into the ground, being a measuring cup to collect a brown amount of water into the soil and use a straw to draw the water out. Note the time it takes to draw the water out. Then, take a second section of 10cm pipe and push it a couple of inches into the ground, being a measuring cup to collect a brown amount of water into the soil and use a straw to draw the water out. Note the time it takes to draw the water out. Then, take a second section of 10cm pipe and push it a couple of inches into the ground, being a measuring cup to collect a brown amount of water into the soil and use a straw to draw the water out. Note the time it takes to draw the water out.



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