



On a mission to put carbon back into soil

French soil scientist Dr Antonio Bispo is on a mission to increase carbon storage in agricultural soil, with the help of funding from the EU and 22 partners from 17 countries across all continents.

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Without soil, there is no life on earth

Bispo and his fellow researchers at CIRCASA project developed a methodology for measuring organic carbon in soil, so that farmers can then adopt tailored approaches to increasing carbon in soil and thereby improve soil health.

Preserving healthy soil is vital. It contains the nutrients upon which humans depend – and which we absorb through food crops. Intensive farming, overuse of agricultural chemicals, other contaminants, erosion and climate change, pose threats to the integrity and quality of our soil, whose long-term consequences are not yet fully understood. But we do know that one centimetre of soil that can take hundreds of years to form can be lost in a single rainstorm.

Setting soil standards

Carbon is naturally occurring – the fourth most abundant element in the universe by mass after hydrogen, helium and oxygen – which we want to limit in the atmosphere to reduce global warming, but which when added to soil enhances soil structure, biodiversity and fertility. How exactly does sequestration, or capture, of carbon work? Bispo explains:

‘Agricultural fields can act as a carbon sink through sequestering carbon dioxide. During photosynthesis crops remove carbon dioxide from the atmosphere and create biomass. When the plants die the carbon goes to the soil: part is used by soil organisms, while the other part accumulates – this is the process of carbon sequestration in soil.’

Bispo was part of an international consortium that included researchers from Germany, France, the Netherlands and the UK, but also from as far away as Australia, Brazil, China, the United States and Madagascar. The effort was coordinated by his fellow Paris-based senior scientist Dr Jean-Francois Soussana, and it has now introduced standards in the monitoring of soil carbon among the world’s leading soil-carbon experts.



Dr Antonio Bispo inside soil bank of the National Research Institute for Agriculture, Food and Environment in Orléans (France)

‘Soil is a huge reservoir of organic carbon,’ explains Soussana. ‘Storing it in agricultural soil contributes to carbon dioxide removal from the atmosphere, to increased soil health, and to the climate change resilience of agriculture.’

The research, says Soussana, ‘mapped for the first time at global scale the current changes in organic carbon stocks of croplands and grassland soils. We identified the potential to store more carbon, and how to monitor this carbon storage in soil through a unique combination of remote sensing, data and calibrated models.’

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Reaping what you sow

Farmers are the ultimate guardians of the soil, and the application of carbon-storage techniques is just one of the ways soil can be protected long term. The consortium surveyed 4 000 farmers across 10 world regions as

part of the initiative, which aimed to answer three main questions from farmers: how they would get paid for increasing carbon, how to get better knowledge on increasing soil carbon, and how to find a simple, cheap and accurate way of monitoring soil carbon.

‘Most farmers are good observers of their soil,’ continues Soussana. ‘They would like to improve soil management, and know about organic matter as a driver of soil health. However, many farmers are not aware of the carbon cycle and of possible changes in their soil carbon stocks. This contributes to a slow adoption of improved practices such as cover crops, grass leys and reduced tillage.’

The remote sensing techniques employed during the research – using Sentinel satellites – could become a ‘world standard’, says Soussana. They allow for the estimation of vegetation cover, organic carbon volume, and the carbon storage potential, of every farm and every field in the EU, and potentially the world.

The long-term ambition, of course, is to make every farmer in the world a sort of ‘carbon farmer’. Better soil health will improve agricultural productivity, with citizens reaping the ultimate benefits through a better diet.

‘Increasing carbon in soil is a win-win solution,’ remarks Bispo. ‘You improve the soil, and at the same time mitigate climate change.’



Samples of soil stored at the soil bank of the National Research Institute for Agriculture, Food and Environment in Orléans (France).

Research and innovation are critically important to develop and upscale knowledge, practices and innovations that will help transitioning towards more sustainable farming systems and rural communities.

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This research is part of the EU's efforts to discover new ways to prepare for climate change, protect our oceans and waters, and fight cancer. Together, EU countries can work more effectively, by pooling funding and expertise from around the world, coordinating international efforts, and benefitting from local knowhow.

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