Zero carbon farm activity sheet

39 Ways to Save the Planet

Royal Geographical Society with IBG

Advancing geography and geographical learning

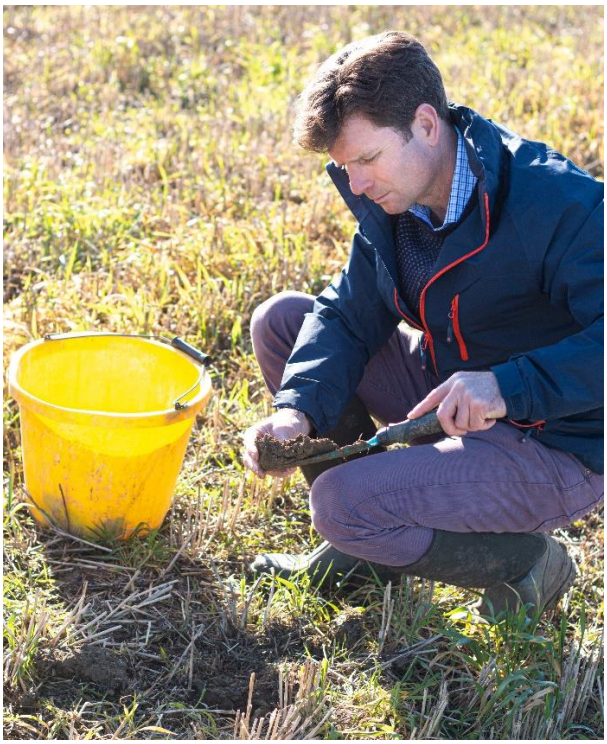
What is a Zero Carbon Farm?

Duncan Farrington is the owner of Bottom Farm in Northamptonshire. He is a pioneering arable farmer who crops 300 hectares in a carbon neutral way, without adding carbon emissions to the atmosphere. Duncan had significantly lowered the farm's greenhouse gas emissions (GHGE) over his tenure in charge of the family farm. Reading Agriculture at Wye College University College London, Duncan and his family became a LEAF Demonstration Farm in 2003 and first produced his now award-winning Mellow Yellow rapeseed oil in 2005, making 6,500 bottles in the first year alone.

To start, listen to the Radio 4 episode Zero Carbon Farm. Below is a summary of Duncan's farming decisions which have precipitated his zero-carbon certification by the United Nations.

Improving soil nutrition, by an 18-year research project	Removes fertiliser use
Reducing cultivations of crops (some are harvested twice)	Needs less tractor fuel
Solar panels installed across the farm, on barn roofs	Renewable energy
Zero carbon employee transport to the farm	EV transport, cycling

In particular, Duncan has focused on increasing the soil nutrition including nitrogen (N), phosphorus (P) and potassium (K). Bottom Farm is especially unique because he has also increased soil carbon over the past 18-years. Therefore, the farm might go further and become a net *adsorber* of carbon if managed correctly.




Duncan Farrington taking a soil sample before the growing season © Farrington Oils

Soil carbon content has increased by 76% over the past 18-years on Bottom Farm. This is an example of small-scale, localised carbon sequestration in the farming industry. It is hoped that this might be both an environmentally and economically sustainable future approach to agriculture.

The farm has 8,000 new trees, replenished hedgerows, grass margins, and crucially the new way of farming creates very little disturbance of the soil. Once the seeds are extracted from the oil seed rape the remaining stem is put through a combine harvester and is spread back across the field — to return the sun's energy to the soil. This ensures that as much carbon as possible is returned and locked back into the soil.

The soil at Bottom Farm is clay, and in 2002 it had a carbon content of 3.8%. In 2020 it was 6.7%. Duncan explains that one of his plots, a 20-hectare field, now takes enough carbon out of the atmosphere to offset 200-middle sized car emissions per year due to his new approach to farming.

1. Four leading academics and Society Fellows have contributed to our What the experts say webpage. Read the page and fill in Table 1 on the 7 positive impacts and co-benefits versus the 3 potential negative impacts.

Positive impacts and co-benefits	Potential negative impacts

Table 1 impacts of Bottom Farm agricultural changes

2. Why do these experts suggest the farming and cultivation of legumes (peas and beans) in arable rotation?

3. Go to the Farrington Oils website. Define and explain what LEAF is, and how Duncan's farm is both carbon and plastic neutral.

Further reading

- Farrington Oils from Bottom Farm www.farrington-oils.co.uk/our-story/
- Will British agriculture be carbon neutral in two decades? www.bbc.co.uk/news/science-environment-49645748
- The NFU: meeting the climate change challenge www.nfuonline.com/news/latest-news/achieving-net-zero-meeting-the-climate-change-challenge/
- A Kent farm www.fwi.co.uk/arable/crop-selection/how-kent-farmer-has-cut-variable-costs-by-focusing-on-soil-health
- Bottom Farm www.leafuk.org/farming/leaf-demonstration-farms/bottom-farm
- How might trees benefit soil and livestock? www.theguardian.com/environment/2021/may/16/im-seen-as-the-fool-the-farmers-putting-trees-back-into-the-uks-fields
- This small change to farming could reduce agriculture's climate impact by 30% www.weforum.org/agenda/2021/04/farming-soil-change-agriculture-climate-impact-research-environment/

Suggested questions for Zero Carbon Farm

a. How much greenhouse gas does a small cereal farm in the UK produce?

b. What is the key thing Duncan does during cultivation to ensure his farming is carbon neutral?

Answers

1. Table suggested answers listed below.

Positive impacts and co-benefits	Potential negative impacts
If converted, arable land could sequester 8% of global carbon emissions	Increase in food prices
We could remove as much as 0.7 Gt CO_2e per year by locking up carbon in soil organic matter	Increase in demand for organic matter
We could convert crop residues into biochar, a charcoal like product, to incorporate into soils	Increase in herbicide use
Reduced emissions from the replacement of diesel-powered machinery	
A radical reduction of GHGE from nitrogen fertiliser manufacture (reducing nitrous oxide)	
Little to no tillage or disturbance of the soil prevents carbon release	
Green electric power such as hydrogen fuel cells	

Table 2 Impacts of Bottom Farm agricultural changes

2. They will reduce nitrous oxide emissions. The rotation will not only increase soil quality but also potentially be a beneficial contribution to UK diets that are currently too heavy in meat.

3. LEAF stands for Linking Environment and Farming — an organisation which promotes sustainable food production. Farmers are encouraged to consider soil management, crop health, pollution control, animal husbandry, energy efficiency, water management, nature conservation, and community engagement.

   Bottom Farm is classified as plastic neutral because of the work done with rePurpose to support the collection and recycling of plastic waste.

   The farm has been designated carbon neutral as emissions have been lowered, with any remaining carbon being offset by reforestation initiatives and green energy schemes.

An RGS-IBG expert

Go to What our expert say to hear further analysis from Dr Tamsin Edwards, Dr Adrian Williams from Cranfield University and Professor Andrew Barnes (pictured below), Professor Bob Rees and Professor Mads Fischer-Moller from Scotland's Rural College.