Featured Farmer Questions

Written By Sarah Wynn – Managing Director of ADAS Climate and Sustainability

Calculating the carbon footprint of a farm is a complex problem. What are the current metrics that exist for doing this and what are their shortcomings?
Is there a need for a standardised metric?
What are the gaps in the current scientific understanding of agricultural emissions calculating?

There are various units of measurement that we could use on farm – emissions per kg of output, emissions per calorie of output, emissions per farm, emissions per hectare. They all have different purposes and will be impacted by why a footprint is being completed and how that data is being used.

There are two broad approaches that are taken to emissions assessment and the Greenhouse Gas Protocol provides guidance on both;

- Product level carbon footprints – These are used to calculate emissions through a system from cradle to grave (ideally) although often taken to the farm gate in the context of farm level assessment. These would for example be the footprint of a tonne of grain, per kg liveweight beef or per litre of milk. You may also look at emissions per hectare to understand the combination of emissions intensity (emission per tonne) and absolute emissions (total emissions from the land used to produce the product). When calculating these emissions you focus on only those activities that relate to the production of that particular output. E.g. in the grain situation you would focus on the field that is used to produce the grain (excluding activities on the surrounding farm – producing other crops, livestock or managing woodland), whilst in the production of beef you need to be following the animal from conception (i.e. its parental emissions) through calving to slaughter – which is challenging where cattle are sold on and off farm at different stages of life.

  These assessments should include all raw materials used to produce the products (manufactured fertilisers, pesticides, medicines, feeds etc), the emissions that occur on farm (nitrous oxide from nitrogen applications, methane from livestock, carbon dioxide from combustion of fossil fuels), and the emissions from imported energy (electricity or heat) – but only that which is used specifically for the product. The advantage of product level assessment is that it enables a footprint to be created that can then be used within the supply chain – e.g. the wheat footprint passes through the distributer (adding transport emissions), through the miller (adding energy emissions from milling), through the distributer (more transport), to the baker (adding more ingredients and energy for baking, plus packaging), through more distribution and retail to the consumer (adding more energy and transport). SO the farm level product footprint is one brick in a chain that cumulatively adds emissions to the footprint of the product. What should and should not be included in a product footprint is set out in the GHG protocol product standards.

- Farm level carbon footprinting – this area is more open to interpretation as you need to clearly define the boundary of your farm level footprint, depending on what it is that you are trying to achieve with your assessment. The main guidance would be GHG protocol organisational footprinting guidance – as this sets out how to assess an organisation and what should and should not be included.

  However, farms are really complex and may contain multiple interconnecting enterprises, including agricultural, diversification, forestry etc. The agricultural enterprises may be interconnecting with straw from one providing bedding for another, which provides organic manure to the first. There is currently no single standard that sets out how a farm carbon footprint should be conducted, instead there is generic guidance on organisations, plus supporting guidance on how supply chains might deal with farm level assessments in the form of the Science Based targets initiative (SBTi) Forestry Land and Agriculture Guidance (FLAG) and the more recent Land Sector and Removals Guidance from GHG protocol. Although none of these are specifically targeted at the farmer, more the industries that are interacting with the farmer. They do however dictate what should be assessed in terms of scope 1 (on farm emissions), scope 2 (emissions from imported energy) and scope 3 (embedded emissions).

- These farm level assessments can potentially be used to demonstrate how the whole farm is performing across rotations or the whole production system is performing in terms of emissions and removals. It brings in greater opportunities to include removals from non-productive areas of the farm (woodlands, hedgerows etc).

Creation of a standardised metric

- I think having a hard and fast metric is not necessarily helpful – as different users may need footprints of different things calculated in different ways for different purposes. Instead I think that what is needed is clearer more specific guidance to farmers as to what a 'farm level' carbon footprint should include and exclude (in terms of activities on farm), and how that farm level assessment is to be used. I think that this would increase understanding of what is being measured and why. This will then help to ensure that any calculation tools are aligned to a standardised boundary.

Gaps in current knowledge

- It is important to realise that carbon footprinting in agriculture is a modelling exercise – it is taking complex biological systems and boiling them boiling them down to simple systems and assumptions. A clear example of this is the approach to modelling soil carbon. Soils are highly diverse in their composition and structure, as well as the practices that have been used historically to manage them. They also respond slowly to changes in practice, especially with regards accumulation of carbon. Trying to create a simplified model that can quantify how these biological processes accumulate or lose carbon will either require significant amounts of data, or include massive assumptions that result in high levels of uncertainty in the results. We generally have good understandings of what practices will lead to reductions in emissions or increases in sequestration, but the ability to accurately quantify is much more challenging. Therefore I see calculation of carbon metrics not as an absolute measure of emissions, but rather as a process of identifying areas of opportunity for emissions reduction and estimation of the potential scale of reduction possible from the adoption of new practices or technologies.

The industry needs to recognise that there is no 'correct' value as everything is modelled, and that the science will evolve in the quantification of emissions, however, the guidance around the practices to implement and the opportunities for emission reduction or increase removals are well understood, and unlikely to be significantly affected by updates to measurement approaches.

Access a Defra commissioned report on Harmonisation of Carbon Accounting Tools for Agriculture here.