Farm Carbon Calculator

Farm Carbon Cutting Toolkit

# Carbon report

Farm name: Shimpling Park Farm

Location: Bury St Edmonds, Suffolk

Enterprises: Arable (wheat, barley, oats, spelt, quinoa), sheep

Farm size: 645 hectares

Soil type: Chalky boulder clay

## Key statistics

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|---|---|
| Total annual carbon emissions | 1,150 tonnes $CO_2e$ |
| Total annual carbon sequestration | 454 tonnes $CO_2$ |
| Total carbon balance (emissions) | 696 tonnes $CO_2e$ |
| Emissions per hectare | 1.08 tonnes CO2e |
| Emissions per tonne of product | 0.45 tonnes CO2e |

## Emissions sources

Total carbon-equivalent (CO2e) emissions amounted to 1,150 tonnes.

The main sources of emissions came from **Fuels** (33.5%) - mostly diesel use, and **Fertility** (54%) - including nitrous oxide emissions from crop residues and green manures.

**Fuels**

**This mostly came from diesel use in tractors and combines (29%)**. There is also diesel used in road vehicles for the farm business. This is to expected in a mechanised arable system.

Electricity on the farm amounted to 4% of total emission, mostly used for grain drying. It's also worth noting that a 50kW array of solar PV panels exports around electricity offsetting 16 tonnes of $CO_2$, as well as providing some 'free' electricity to the farm.

Note: $CO_2$ stands for carbon dioxide
$CO_2e$ stands for carbon dioxide equivalence – i.e. other greenhouse gases are included, but converted to a standard unit to represent the global warming impact of carbon dioxide

## Materials

It's worth noting that materials used on the farm, including wood, water, metal, paper and tyres amounted to just 0.1% of total emissions.

Nonetheless it is worth recording these items because embodied energy in concrete and steel in particular can have large carbon impacts on large projects – for instance a new barn, shed or farm roads.

## Capital items

As mentioned above, there is a lot of embodied energy in steel, which is exposed in calculating the impact of farm machinery. In the Farm Carbon Calculator, any machine under 10 years old is accounted for, and depreciated over 10 years.

**The manufacture of tractors and telehandlers on this farm amount to 3.7% of total emissions**. However if these were all bought in one year and accounted for in one year (not depreciated over ten) then the impact would be 37% of total emissions.

## Fertility

**Nitrous oxide emissions from crop residues of arable crops (beans, peas, wheat and oats) contribute to a large percentage of total emissions at 29%**. This is due to nitrogen in the crop residue being oxidised in the soil and being released as nitrous oxide.

**Leguminous green manures (red clover) contribute a further 17% of emissions** through nitrous oxide released during nitrogen fixation. This appears to be a very negative attribute of green manures, however they can also contribute to a substantial increase in organic matter levels, which sequesters atmospheric carbon. In effect this at least 'balances out' the nitrous oxide emissions.

Also worth mentioning is the 2.8% of emissions from the application of rock phosphate.

## Livestock

The farm has a herd of **250 sheep, which contribute 6.6% of emissions** from methane through the process of enteric fermentation (common to all bovines).

## Distribution

Transport of arable crops to a local mill accounts for 1.3% of emissions. Whilst this is not delivery to the final customer it demonstrates that 'food miles' can be only a small part of the issues relating to climate change and food.

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# Sequestration sources

Carbon is sequestered in perennial biomass and soils on farms. On this farm **60% of carbon is sequestered in woodlands, whilst permanent field margins (21%) and hedges (18%) are the other main carbon sinks**.

The total carbon sequestered on the farm (454 tonnes of $CO_2$) offsets 40% of all carbon emitted by the farm business.

Note that soil organic matter levels have not been sampled – see discussion below.

# Notes

The major omission to this calculation, due to lack of data, is that **soil organic matter levels have not been measured**. See below for discussion of this issue.

A comprehensive calculation of materials used (e.g. wood, steel, concrete, etc.) was not undertaken due to time limitations. However this was not expected to be a significant source of emissions as a percentage of total farm emissions.

An analysis of embodied energy in farm buildings was not carried out, also due to time limitations. This would be worth looking at in future calculations, but is not considered that emissions from embodied energy in buildings would skew the figures dramatically.

# Discussion

In organic systems a major aim is to cultivate soils in a manner that builds fertility continuously. This should go hand in hand with raising organic matter levels, which also means atmospheric carbon is being sequestered in the soil.

For example a 0.1% increase in SOM on clay soils, per hectare per year, can sequester nearly 7 tonnes of $CO_2$. If this applied to the whole of Shimpling Park Farm then the annual carbon sequestration from soil alone would amount to almost **4500 tonnes of $CO_2$, four times greater than total carbon emissions!**

Is this achievable? In the Soil Association paper *Soil Carbon and Organic Farming* (2009) a comprehensive analysis of studies is made that examined soil organic matter (SOM) levels in farming systems across the world. There was a huge range of results in temperate organic arable systems, from SOM increases of 0.5% per year through to annual SOM losses. However it confirmed that annual SOM gains of 0.1% are perfectly achievable.

Even if annual SOM gains were just 0.025% then on this farm the carbon sequestration in soil would equal all the carbon emissions from the business. **Add to this the sequestration from biomass and the farm would have net carbon sequestration.**

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