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FARMERS WEEKLY

TRANSITION

Securing a sustainable future for your farm business

THE CARBON CONUNDRUM

How to choose the best calculator and scheme

How to make sense of carbon farming

Welcome to the sixth edition of *Transition*, the *Farmers Weekly* supplement to help secure a more sustainable future for your farm business.

This issue of *Transition* looks at how farmers can make the most of carbon – in ways that can reduce farm input costs and generate valuable revenue streams – while benefiting the environment and wider society.

We start by looking at ways growers and livestock producers can choose the most appropriate tool to calculate the carbon footprint of their farm – from a quick and easy assessment to something much more sophisticated.

We then ask what farmers can do to reduce greenhouse gas emissions before unpicking the various schemes that promise to pay producers for more advanced carbon management strategies, including sequestration.

We also examine how woodland can create a carbon-based income.

Finally, we have some sage advice on the importance of checking the small print before joining a carbon scheme – including reading our plain-English, jargon-busting glossary designed to make carbon easy to understand.

As always, we are grateful to our Transition Farmers, who are sharing their stories as they adapt to this new world. We are equally grateful to our Transition Partners, for sharing their expertise and advice along the way.

For more about our Transition initiative, visit our knowledge hub at **fwi.co.uk/transition**

Johann Tasker, *Transition* editor

MAIN PHOTO: MARK RICHARDSON/ALAMY STOCK PHOTO. SEAN EBSWORTH BARNES. INSET: GARY NAYLOR, TIM SCRIVENER, WAYNE HUTCHINSON

OUR PARTNERS

The *Farmers Weekly* Transition Partner Network is a UK-wide community of farmers, industry stakeholders and influencers working together to secure a sustainable future for UK agriculture. If you are interested in joining the network and would like to find out more, please contact Anna Eccleston at **anna.eccleston@markallengroup.com**

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Supporting the transition to nature-friendly, low carbon farming.

As an own brand retailer, M&S is uniquely positioned to work with our long-standing, trusted supplier partners to find new and better ways of doing things. We're committed to helping our Select Farmers and Growers address the challenges of climate change, biodiversity loss, soil health and water and energy use through our Farming with Nature programme.

Our network of Indicator Farms across the UK is helping to enable innovation and trial new environmental practices. And we are working with all our British Select Farmers and Growers to monitor environmental activity and support improvements, with the aim of aiding the transition to nature-friendly, low carbon British farming systems.

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Meet our Transition Farmers

These 16 farmers are sharing their journeys with us as they adapt their businesses

Karen Halton
Cheshire

Farm size 240ha

Enterprises
530-cow dairy herd

Transition goals
- Recruit/retain staff
- Maintain animal health and welfare
- Increase direct sales

James MacCartney
Rutland

Farm size 162ha

Enterprises
Beef and sheep

Transition goals
- Reduce disease in sheep
- Be better than net zero
- Establish herbal leys

Vaughan Hodgson
Cumbria

Farm size 244ha

Enterprises
Cereals, grassland, broilers

Transition goals
- Support the next generation
- Replace lost Basic Payment Scheme income
- Adapt to uncertain weather

Alan Steven
Fife

Farm size 138ha

Enterprises
Potatoes, brussels sprouts, parsnips, malting barley

Transition goals
- Reduce cultivations
- Improve soil health
- More resilient rotations

Andrew McFadzean
Ayrshire

P36

Farm size 195ha

Enterprises
350 beef cattle, wheat, beans, barley, fodder beet

Transition goals
- Slash finishing time
- Reduce dependence on inputs using solar energy
- Improve grassland

Rachel & Richard Risdon
Devon

P8

Farm size 110ha

Enterprises
300-cow dairy herd

Transition goals
- Secure adequate labour
- Better understanding of Environmental Land Management
- Reduce carbon footprint

Kit Speakman
Essex

Farm size 275ha

Enterprises
Mixed arable, beef and sheep

Transition goals
- Bridge income gap
- Fully diversified business
- Widen the rotation

Eddie Andrew
Sheffield

P21

Farm size 73ha

Enterprises
Dairy, milk delivery service, ice cream parlour and farm shop

Transition goals
- Co-operating to reduce costs
- Establish a new dairy
- Reduce carbon footprint

Irwel Jones
Camarthenshire

Farm size 375ha

Enterprises
1,500 ewes on owned and rented land, suckler cows and followers, root crops

Transition goals
- Manage natural woodland
- Plant hedgerows
- Rely less on volatile inputs

Andy Bason
Hampshire

P33

Farm size 800ha

Enterprises
Cereals, spring beans, oats, linseed and oilseed rape

Transition goals
- Cut carbon emissions by 30%
- Establish 10ha of agroforestry
- Establish 10ha of woodland

Alistair Hall-Jones
Lincolnshire

Farm size 680ha

Enterprises
Cereals, oilseed rape, spring beans, sugar beet, forage maize, anaerobic digestion, 900 sows

Transition goals
- Recruit/retain first-class staff
- Pursue technical efficiencies
- Pay back borrowing

Duncan Blyth Albanwise Farming, Norfolk

Farm size 2,650ha

Enterprises
Cereals, oilseed rape, sugar beet, pulses, grassland, woodland, wetlands

Transition goals
- Improve soil health
- Develop natural capital revenues
- Achieve net zero by 2030

Philip Vickers
County Durham

P14

Farm size 1,250ha

Enterprises
Winter wheat, oilseed rape, spring barley, spring beans, lupins, rotational grass; share-farming agreement with tenant sheep farmer

Transition goals
- Maintain margins while changing approach
- Improve soil health and resilience
- Enhance natural environment

Kate and Vicky Morgan
East Yorkshire

Farm size 1,700 breeding sows

Enterprises
Weaning 1,000 pigs a week – finished on-site and through B&B arrangements with local farmers, 140ha rented out

Transition goals
- Facilitate structural change in supply chain
- Establish more influence over own destiny
- Diversify

Ed Shuldham
Wiltshire

P26

Farm size 1,800ha

Enterprises
Cereals, oilseed rape, oats, forage and grain maize, peas, solar, biomass, anaerobic digestion, events and property diversifications

Transition goals
- Help shape Sustainable Farming Incentive through participation in pilot
- Make more use of data
- Take natural capital

Fergal Watson
County Down

Farm size 285ha across three units

Enterprises
170-cow suckler herd, beans, wheat, spring barley, oats

Transition goals
- Recruit/retain farm staff
- Restructure suckler herd
- Improve business resilience

Visit our Transition hub to find out more about our Transition Farmers
fwi.co.uk/transition-farmers

Varietal choice will have an increasingly important role to play in delivering more sustainable crop production, says independent soil specialist Neil Fuller

To find out more
Call 01763 207300
Email info@kws-uk.com
Visit www.kws.com

Why varietal choice will play an increasing role in a more sustainable future

Modern genetics can do much to make the transition to more sustainable cropping as productive and profitable as possible.

Understanding more about soils is an essential starting point for any sustainable crop production system and key to making the correct varietal choices in the future, says independent soil specialist Neil Fuller.

Selecting varieties that have the ability to produce good root systems and develop strong interactions with beneficial microbes is increasingly important, he believes

"Over 75% of a plant's nutrition comes from the top 10cm of soil so making sure it is open, friable and biologically active is absolutely essential. Anything that restricts root development can undermine how beneficial microbes feed and protect the growing plant.

"A variety's ability to produce an abundance of shallow roots is a key factor in any production system but it is of critical importance in more regenerative approaches where plants have to thrive in an environment of reduced agronomic support.

"Whilst roots closer to the surface are key to boosting N utilisation efficiency in lower input systems, they also pump carbon into the soil to promote biological activity, which in turn builds healthy soil and adds a greater degree of resilience to crops."

Varietal performance can be enhanced by appropriate soil management in this top layer with poor practices impacting on both production and the environment, he points out.

"Soil compaction or poorly incorporated organic matter, such as straw, can lead to dense anaerobic layers. Subsequently, nitrogen sitting in cold wet soil can turn to nitrous oxide, which has the potential to be lost from the soil at the rate of 5kg/ha/year.

"While this loss might not be noticed agronomically, it has the greenhouse gas equivalent of 1.5 t/ha of carbon dioxide entering the atmosphere every year which is highly significant."

Look below the surface

Olivia Potter, technical specialist at KWS, agrees saying whilst the focus in recent years has been on how plants perform above the ground, greater understanding of what happens below is now needed.

"It's highly likely that the plants that have the highest Nitrogen Use Efficiency (NUE) and the greatest levels of in-built resilience are the ones which also have the most appropriately adapted root systems.

"High untreated yield is usually an indication of plant resilience and resistance to abiotic stresses so it's no surprise that varieties like KWS Extase, Palladium and Dawsum with 90% plus untreated yields on the latest RL also have strong agronomic traits.

"These can be in the shape of disease resistance but other factors such as standing power, stem stiffness and early harvest potential can also be important in more regenerative scenarios."

Min till performance

With no-till and min-till an increasingly popular cornerstone of regenerative practices, how varieties perform with these approaches is also important, she says.

"Reducing tillage is often associated with yield penalties in the first few years, but our trials have shown KWS Extase and KWS Cranium delivering yield losses as low as 0.2t/ha when comparing their no-till performance to that in a full cultivation system.

"Both varieties perform well in the late drilling slot so this could be behind their strong no-till performance and such varieties could well be the best bet for growers transitioning to no-till systems.

"The new Group 4 hard wheat KWS Dawsum also has many of the features required to deliver optimum performance in a more regenerative approach.

"For a start it's got high outright yield at 104% of control indicating it uses available Nitrogen very efficiently but it also has a high untreated yield at 92% - just 1% behind KWS Extase at 93%.

"It's a great example of how our SPP (Sowing for Peak Performance) thinking is influencing the type of genetics we are bringing to the market to help growers meet the challenges of the future."

Four popular carbon calculators compared

Understanding carbon on farm often starts with a carbon audit. **Mike Abram** looks at the tools available

Strategies to improve the economic situation on a farm will very often result in also reducing your carbon footprint, which can make a carbon audit a useful benchmarking exercise for farmers.

Farms with a low carbon footprint are often the most efficient and profitable, subject to land use and type, and sector, says Simon Haley, director of consultancy firm Carbon Metrics, which helps farmers develop ecologically and financially beneficial carbon management plans.

"Nine out of 10 times, the mitigation options in a carbon management plan are also good business efficiency recommendations."

The starting point for understanding a farm's carbon footprint is usually entering data into one of the many calculators that have been developed in the past 10-15 years.

Four calculators have emerged as popular general tools for most types of business – the Cool Farm Tool, Farm Carbon Calculator, Agrecalc and, more recently, Trinity AgTech's Sandy. All are consistently improved as new science and information emerges, with most updated on a yearly basis.

Deciding which to use will to some extent be dictated by your aims – whether it is simply to measure your carbon footprint, benchmark against others, or meet supply chain requirement. It also depends on what type of farming you do, and whether you're interested in potentially selling carbon credits.

In addition, there are a number of sector-specific and/or in-house calculators, such as Arla's Climate Check (see "Transition Farmer Rachel Risdon, Devon", p8), Alltech's E-CO2, Eggbase, Promar, AB Agri's Intellync and Sustell from nutrition company Royal DSM. These are well worth considering if you're in those sectors or supply chains, with most including comprehensive livestock productivity metrics, for example.

Agrecalc

Good for: Mixed and livestock farms, and benchmarking

Initially developed as a research tool by SRUC and SAC Consulting, Agricultural Resource Efficiency Calculator (Agrecalc) is free for individual farmers, offering one farm profile and report a year, and access to general industry benchmarks.

For £85/year this can be upgraded to allow multiple reports, including what-if scenario planning and access to detailed benchmarks. Multiple farm profiles and group benchmarking costs £105/year. "That kind of comparative data is important to understand what your results mean," says Agrecalc's agricultural systems modeller, Kaia Waxenberg.

>

DO DIFFERENT CALCULATORS GIVE DIFFERENT RESULTS?

Twenty model farms representing every key type of UK farming are being used to find the extent to which common carbon calculators diverge in their estimates of carbon footprints in a Defra-funded project costing nearly £100,000.

The project, which is being carried out by Adas and due to be completed by next June, will compare Farm Carbon Calculator, Agrecalc, Sandy, Solagro and Cool Farm Tool, as well as a few sector-specific calculators.

"The model farms have been created to push the calculators as much as possible," explains Adas's Toby Townsend. "Some include newer technologies or less common enterprises, and range from simple rotations to more complex mixed farming systems."

A key objective is to identify and understand the importance of the reasons behind different results, particularly for emissions sources such as enteric methane, manure storage and management, soil nutrient management and land use change.

"The next steps will help target development of improved methods to boost consistency across tools, assisting users in selecting the most suitable."

GARY NAYLOR

EMILY FLEUR

TRANSITION FARMER RACHEL RISDON, DEVON

Rachel Risdon was asked by her milk buyer, Arla, to complete its Climate Check tool for her 300-cow, grass-fed dairy business. Arla is among a number of businesses to develop or use sector-specific, in-house emissions calculators for their supply chains.

Data is gathered through 203 questions, answered online, with the preliminary carbon footprint validated by an external agricultural climate adviser.

Most of the questionnaire was reasonably straightforward, such as completing animal numbers and land use, says Mrs Risdon. "The more complicated bits were working out fuel use, especially as we primarily use a contractor. The fuel price rises did mean the contractor knew exactly how many litres of fuel he had used an hour doing each job."

In total, it took about three to four hours to complete, although if the contractors hadn't known the relevant information that would have added at least another hour, she says.

Unfortunately, with the Arla dairy contract also including the farms of her two brothers-in-law, Arla has insisted on the Climate Check being combined with their businesses. "That will make the results slightly meaningless," she says.

● Follow Rachel Risdon and our other Transition Farmers. Find out more on p5

< Agrecalc footprints the whole farm before using the data to also provide enterprise- and product-specific reports. "The allocation of emissions across the whole farm is something that is quite specific to Agrecalc. For example, if you grow silage that you feed to cattle on the farm, Agrecalc, unlike other tools, automatically allocates that to the cattle enterprise."

Farmers input data into three main sections – land and crops, livestock, and energy and waste. User guidance and downloadable PDFs help with requirements. First time use usually takes about two-and-a-half hours, with future entries roughly an hour, says Miss Waxenberg.

The greater overall detail, such as inclusion of livestock performance and efficiency metrics and detailed feed emissions, arguably gives a more meaningful result. Soil carbon sequestration is measured for all grass and arable crop land to Intergovernmental Panel on Climate Change (IPCC) Tier 1 standards, with another module for hedgerows.

Improvements to nitrous oxide emissions calculations from fertiliser and manure use were released in October to make them more specific to UK climate and soils.

A new platform is due to be released this winter, which will improve the user experience, with future iterations likely to include automatic data pulling from third-party sources, such as BCMS and crop recording platforms. Other improvements include emissions from additional specialised feeds and additional crop enterprises, although UK commonly grown crops are in the current version.

● **For more details, visit agrecalc.com**

Cool Farm Tool

Good for: Simplicity and product supply chains

Run by the Cool Farm Alliance (CFA), and backed by 140-plus members – including big multinationals such as Unilever, PepsiCo and Syngenta to NGOs, agronomy firms and farming businesses – Cool Farm Tool has been available since 2014.

The collaboration helps with industry alignment to transition agriculture to a more sustainable future, says Richard Profit, CFA's chief executive. "It brings consistency, accountability and transparency."

Once filled in by farmers, the assessment can be shared with all buyers of their crops or products, saving potentially having to fill in multiple tools. It's predominantly aimed at arable, beef and dairy farmers, although can be used for other livestock. Upland farming is less suited.

TYPICAL DATA REQUIRED FOR CARBON CALCULATORS

- Cropping data – crop types, yields, areas, inputs etc
- Livestock – herd or flock size, feed use, manure management
- Energy and waste – fuel and energy use, water use, plastic waste and transport

Note: Data required varies by model so might not include all of the above

Data entry is simplified. "We minimise the data needed and restrict it to the different inputs the farmer has influence over," Mr Profit says. That means an assessment could be completed within an hour, if data is readily available.

A major difference to other tools is the output is based on a crop or product basis, rather than at a farm or enterprise level – important for supply chains. Whole-farm modelling is available for biodiversity assessments and will be extended to greenhouse gases in the future, Mr Profit says, although it is possible to consolidate separate assessments to create a whole-farm view.

Sequestration is calculated through land-use change and changes in above-ground biomass, while it uses data on animals bought, sold and born to calculate average time on farm and weights in each category. Livestock enteric emissions are calculated and in the near future will also include feed additives as a mitigation measure.

It is free for farmers for up to five assessments – each crop or product is a different assessment. Users often also get free access beyond that via suppliers. Next year's spring update will complete the switch to IPCC 2019 methodology started in this year's update, a new soil organic carbon model, and update to nitrous oxide emissions and various updates to beef and dairy modules. Controlled environments and improved perennial crop models are also in development.

● **For more details, visit coolfarmtool.org**

Farm Carbon Calculator

Good for: Ease of use, live results and range of farm types

Farm Carbon Toolkit developed its online Farm Carbon Calculator from 2010 as part of its aim to help farmers understand, measure, and reduce their farm's carbon footprint.

Data is gathered for nine sections covering similar areas to the other tools. An Excel spreadsheet can be used to help identify and record data before entry. Typically, it takes about two hours to do the first report once data has been collated, which if the farm is well-organised might take two to three hours.

The user interface was redesigned for the last big update, but a major project to rebuild the calculator's back end is under way for next year's updates. That aims to improve automatic integration with various farm software programs as well as allowing uploading of Excel files to make data entry easier.

Output is on a whole farm or enterprise basis. It's possible to have results on a product basis but needs to be a separate report from the start. The report shows in various levels of detail the farm's carbon emissions, sequestration and balance, explains Jonathan Smith, who co-developed the calculator. "Benchmarking is currently against other users in your enterprise type, but we're working on version two to analyse the data and present it in a better way."

The last update introduced a nitrogen module, with the help of WWF, and updated livestock emissions with the latest IPCC methodology. The intention is to show both global warming potential (GWP) and GWP* for methane in the future, Mr Smith says.

How manure is stored and spread can have a significant impact on emissions

GARY NAYLOR

Soil carbon sequestration calculations have been improved, based on results from two years' soil analysis using a recommended sampling method.

Livestock numbers are calculated on an average over a 12-month period, using start and end numbers and how many bought and sold during the year.

The calculator is free for farmers. A paid-for consultancy service is available to help businesses take the next steps including creating a carbon action plan.

● **For more details, visit calculator.farmcarbontoolkit.org.uk**

Sandy

Good for: Detailed calculations, automatic link to carbon trading scheme

Unlike other models, Trinity AgTech's Sandy does not have a free version, costing £588/year for one farm less than 1,000ha, rising to £1,500/year for farms of more than 1,000ha.

Set-up is through a five-step process starting with an API that links with Gatekeeper and Muddy Boots to bring in rotational cropping and operation data, which is automatically kept up to date. Similar links to livestock platforms are planned. Data can also be added directly or via Excel templates, says Oliver Rubinstein, customer success manager for Trinity AgTech.

Basic field information is required, and a digital field map can be created using field boundary data imported directly from the Rural Payments Agency if in England, or by uploading from other systems. Historical climate data is assigned by the field's location.

Carbon sequestration is calculated by a blended model using soil test analysis and modelling to Tier 2 IPCC 2019 standards, as are all its calculations.

Livestock farmers add data around grassland sward species, management, fuel use, as well as milk production, herd dynamics, and comprehensive livestock productivity metrics and feed rations. There are specific models for both upland peats and organic systems.

Outputs can be on a field, enterprise or farm level, with net carbon balances shown alongside farm emissions and sequestration. Permanent grassland is treated separately to livestock. Drill down into enterprise and more information is presented, such as emissions intensity, source and breakdown by greenhouse gas. Methane emissions are presented by both GWP and GWP*.

Currently arable-focused, a nice feature is the ability to model the impact of changes in farm practice, such as switching to zero-till or adding an agroforestry scheme. It can also create up to six management plans based on criteria entered, such as reaching net zero without any impact on production, Mr Rubinstein explains. "We're trying to help farmers make use of this information."

It also links directly into Trinity's Natural Capital Markets carbon trading scheme, making it easy to understand the potential value currently and of management changes.

● **For more details, visit trinityagtech.com** ■

AT A GLANCE: FOUR CARBON CALCULATORS COMPARED

	Farm Carbon Calculator	Cool Farm Tool	Agrecalc	Sandy
Number of users	7,000	>25,000	Many 1,000s	300
Launched	2010	2014	2012	2022
Assessment type	Whole farm, and kg/output	Product only (greenhouse gas)	Whole farm, enterprise and product	Whole farm, enterprise and field level
Carbon sequestration	Soil, woodland, hedgerows, perennials	Land use and biomass change only. Soils in spring 2023	Soil, woodland and hedgerows	Soil (including permanent grassland), woodland and hedgerows
Livestock performance metrics (eg, mortality and fertility data)	No	No	Yes	Yes
Next major update	Summer 2023	Spring 2023	Early 2023	Monthly updates
Benchmarking	Yes, versus other users of similar enterprise. More detailed benchmarking in development	Spring 2024	Yes (more detailed in paid version)	Yes – gives assessment of farm versus own best and worst performance
Bolt-on assessments?	No	Biodiversity, food loss and waste and water	No	Biodiversity, water protection
Cost	Free to farmers	Free for individual farmers	Free to farmers (£85-£105/year brings extra functionality)	From £588/year

How data helped transform beef herd efficiency

Carbon auditing is improving business performance and reducing emissions on a Northamptonshire enterprise. **Mike Abram** reports

Beef producer Tim Phipps is one of a number of farmers lowering his carbon footprint thanks to data collected by ongoing greenhouse gas audits.

Data insight experts Map of Ag says its platform addresses a weakness of some existing carbon calculators – providing insights that help farmers understand how to improve in metrics that are easily understandable.

Map of Ag has built connections with key data sources, including some the main carbon calculators don't currently use, such as British Cattle Movement Service (BCMS), explains Hugh Martineau, Map of Ag's head of sustainability. This increases accuracy of greenhouse gas emissions when used in conjunction with other data sources, such as farm management software and kill data from abattoirs, as well as from Mr Phipps.

The carbon audit is presented in a similar way to other calculators, comparing emission intensity, with breakdowns by each greenhouse gas and benchmarking against other farms.

Where Map of Ag adds value is by automatically generating key performance indicators based on the data collected. "Tim's efficient system already produces low emissions-intensity beef, so high-resolution data is important to help identify where additional emissions reductions can be achieved," says Mr Martineau.

The analysis is providing valuable, actionable information in three areas for the 340ha mixed family farm, which runs 150 Stabiliser cows. These will improve both business performance and reduce overall emissions by about 15% on the Morrisons' Blueprint demonstration farm.

Beef producer Tim Phipps sells bulls at 12-24 months to Morrisons

MORRISONS

Attention to detail straight after calving

Farm slaughter data highlights the disparity between finishing efficiency for bull calves and heifers. Mr Phipps, who farms in Northamptonshire, sells bulls at 12-14 months for beef to supermarket chain Morrisons. Heifers unsuitable for breeding are grazed for a second year prior to being sold at 23-24 months.

Target slaughter weights for bull calves are 375-410kg deadweight, but a few underperformers bring down the average. In contrast, there are lower and more variable deadweight and age at slaughter figures with the finished heifers.

"Intrinsically these are the least efficient in our herd. Anything that hasn't reached 400kg at 400 days isn't selected for breeding. Being able to see the outliers in both situations is really useful on understanding what to do better," Mr Phipps says.

For example, there is a correlation between animals that have not had adequate colostrum transfer at birth, he explains. "That means they have been poorly early in life, upsetting their rumen, and means you're fighting against poor rumen performance all their life."

Greater attention on monitoring calves to make sure they feed within the first few hours of life should help mitigate this, he says. "And if there is anything wrong, we will give them a boost of colostrum."

Use sexed semen to improve efficiency

The project has helped identify 32% lower greenhouse gas emissions in finished bulls compared with finished heifers. With the help of Morrisons' net-zero project partners Raft Solutions, Mr Phipps is hoping to trial sexed semen in his beef cows to target maternal genetics in the animals bred as replacements.

"We always breed our replacements with the best genetics in the hope we can retain those animals as our future replacements," Mr Phipps says. "This means we can also target terminal beef traits in animals less suitable for breeding replacements." This more precise approach should produce more, low emissions beef.

Reducing N and protein requirements

Another strand to lowering emissions is by reducing protein requirements and the use of synthetic fertiliser.

Mr Phipps is working with his beef nutritionist and Raft Solutions to reduce dietary protein requirements by monitoring rations and trialling the inclusion of synthetic amino acids (methionine). This approach is used in pigs and poultry and should help reduce crude protein requirements in rations.

More legume-rich swards are being introduced into the arable rotation. "By growing the legume-rich swards and cutting the forage at the right point, we're hoping that should negate the need to import protein concentrates," he explains.

The increased area of legume-rich swards should also decrease the amount of fertiliser required on the rest of the grazing platform, and in the following wheat crop. ■

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Confidently take control of your natural capital

To resiliently lead your farm through unprecedent volatility, uncertainty, complexity and ambiguity, it's more important than ever to confidently take control of your natural capital for analysing and choosing your path forward.

Thankfully, there is now a comprehensive, easy-to-use, next generation navigator to support you in your decision making and provide you with the most trusted analytics for your farm's natural assets.

Building a scientifically reliable and accurate picture of your carbon, biodiversity and water quality status and examining your options, can support you to make decisions and adapt your farm practices, knowing what the costs, benefits and impacts will be.

Driving farm productivity and environmental improvements simultaneously, at a time of unprecedented industry and political change, can be overwhelming. But using the latest science and evidence to understand your farm's natural capital, will help you make confident forward decisions and build your farm's business resilience from the soil up.

The inherent value of natural capital

Maintaining and enhancing your natural capital is pivotal to success and is something all farms can manage and profit from, without having to wait for ever-changing policy directives.

Building insights and refining a number of on-farm practices can not only reduce costs and have a direct impact on profitability, but also on a farm's sustainability credentials.

Fundamentally, improving your farm's natural capital metrics has an all-round positive impact. The challenge to date has been credibly and rigorously understanding the full breadth of this value and the options for all farm types and systems.

It's not just about carbon

Not only can Sandy support farmers to navigate their natural capital, it also uniquely forecasts the impact of management changes on carbon and biodiversity metrics through scenario planning.

Moreover, it does so for every farm type, generating reliable statistics across all sectors, creating universal analytics which farmers can use to learn from one another.

Additionally, Sandy can measure and evidence a farm's impact on water quality, through an enhanced water module. Utilising more than 300 data points, this module can support farmers to:

- Protect water through a substantial reduction in nitrate leaching
- Reduce costs by analysing each farm and field's nitrogen uptake efficiency on a daily basis, reducing nitrate wastage
- Reduce carbon dioxide equivalent emissions from fertiliser applications – significantly improving a farm's sustainability or carbon score

The water protection module achieves this by:

- Optimising nitrogen use and reducing nitrate leaching in real-time
- Enabling a precision approach to nitrogen applications through an advanced real-time alert system
- Integrating with existing farm management software to reduce data input

Profit from confident decision making

We may not be able to predict what the future looks like, but success doesn't require this. What will deliver success is to understand the natural capital on your farm with authority, and to profit from your decision making.

Taking control and understanding the true extent of the value that natural capital, soil carbon, biodiversity, and water quality can offer farmers, is a fantastic place to start.

What arable farmers can do to reduce emissions

Growers have plenty of options when it comes to cutting the generation of greenhouse gases from their farming activities. **Louise Impey** reports

UK farming's ambitious goal of reaching net zero by 2040 is going to require some changes in arable farm practices and a willingness to think differently about resources if emissions are to fall.

The top three actions – changing farm practices, increasing productivity and making better use of inputs and resources – can all make a significant difference, with farms aiming to reduce their impact while maintaining productivity.

Of the three main greenhouse gases (GHGs) associated with the farming industry (see "What are the main GHGs in agriculture?"), arable farming activities are most closely associated with two of them – nitrous oxide and carbon dioxide.

Nitrous oxide arises from nitrogen fertiliser production and application, while carbon dioxide comes mainly from fuel use and field operations.

The other GHG that is attributed to farming – methane – is only relevant to arable farms that are importing manures.

Starting point

Any farm business that wants to start to reduce GHG emissions must understand what the current on-farm situation is and what data is available, so that they understand their starting position and the potential to reduce emissions.

While it may initially add to the office work burden, carrying out a carbon footprinting exercise gives a baseline and can then form a foundation for decision-making, allowing appropriate action to be taken.

THE MAIN GREENHOUSE GASES IN AGRICULTURE

- Carbon dioxide – comprises 12% of total emissions and is created by energy use, specifically fuel use and processes associated with the production of materials and inputs
- Methane – accounts for 56% of farming's emissions and comes from enteric fermentation in ruminants and manures
- Nitrous oxide – forms 31% of the industry's emissions, with a large proportion arising from soil as fertiliser breaks down and nitrification occurs. Farm storage and use of manures/organic amendments is another source

As Emma Adams, senior farm carbon and soils adviser at Farm Carbon Toolkit, explains, there is mounting pressure on farmers from the supply chain to know what the carbon footprint of their business is, but there are also compelling internal reasons for doing so.

"Completing the process will give you a position of knowledge and make it possible to identify the hotspots for emissions, which are a good place to focus when making reductions," she says. "There are free online tools available that will help you to carry out the exercise. You don't have to spend lots to establish where you are at the moment and identify if any changes in practice need to be made."

She adds that the on-farm elements that have a high carbon cost tend to be expensive, such as fuel and fertiliser, so giving them attention will bring further benefits to the farm. "That is why maximising the efficiency of resources used is a big part of improving your carbon footprint," she points out. "By focusing on carbon, building resilience into farming systems and improving resource efficiency, you can maximise productivity and minimise waste."

GREENHOUSE GASES (GHGs) FROM ARABLE SYSTEMS

- 60-70% of GHGs comes from nitrogen fertiliser use
- 20% of GHGs comes from fuel use and field operations
- 10-15% of GHGs produced by P&K fertilisers, organic manures and liming
- 10% of GHGs comes from sown seeds
- 1% of GHGs comes from crop protection chemicals

JARGON BUSTER
For a plain English A-Z guide to net-zero terminology, see **p39**

TIM SCRIVENER

Fertiliser

Nitrogen fertiliser is one of the biggest culprits when it comes to GHG emissions from arable farms, as nitrous oxide emissions arise from its production and use.

A very potent GHG, nitrous oxide comes from fertiliser use and attributes about 50% to the manufacturing process and 50% to its use. The gas is released during spreading and when on the field, through processes such as volatilisation, leaching and direct loss.

It is a priority area for the industry and one that fertiliser manufacturers are addressing. For instance, Yara has announced it intends to use green ammonia in carbon-neutral fertiliser products, the raw materials for which will be obtained using carbon dioxide-free energy sources rather than fossil fuels.

Until there's been more progress, there are several actions that growers can adopt to reduce their reliance on nitrogen fertiliser. However, they may also need to set themselves an overall fertiliser reduction target, says Ms Adams.

"Improving soil health, incorporating cover crops, widening the rotation and using organic sources of nitrogen are all helpful and should be part of the plan. Nitrogen fertiliser often makes a large contribution to the emissions of an arable farm. If you are reducing your use of inputs – either through better practice or technology – your emissions will fall. So, too, will the financial overhead."

Other actions that can include the sourcing of fertiliser products – with those coming from the UK or Europe usually having a lower emissions factor than product coming from China, for example.

Inhibitors, used to slow the conversion of ammonium to nitrate, have a role with urea products and help to improve nutrient use efficiency (NUE), which remains low with many granular fertiliser products. "The standard figure for NUE from granular products is 60%," says Ms Adams. "So we know that 40% is being lost at the outset and we need to consider how to minimise these losses."

Good practice may be boring but it is effective. "It's about putting on the right product, at the right time and in the right place. Given the very high cost of many fertilisers, it makes sense to apply it with accuracy, when the weather and plant growth is going to maximise uptake of the product."

Phosphorus and potassium fertilisers do not have the same level of nitrous oxide emissions associated with their use but do have a cost in terms of mining and hauling.

"There's a much lower footprint with an organic source of these nutrients, so the use of muck, other organic fertility sources, or improving the uptake of existing nutrient stocks through methods such as cover cropping can help."

Fuel

Fuel use makes a large contribution to emissions on a volume basis, although the resulting carbon dioxide produced from its use is less polluting than nitrous oxide. As far as savings are concerned, there are some easy ones, says Ms Adams, who notes that the technology exists to track fuel use in real-time. >

YEN ZERO RESULTS

Growers can cut a crop's carbon footprint by 41% without affecting yield through a combination of minimising cultivations, reducing grain drying requirements and using less artificial fertiliser, according to results from 50 farms in the Adas YEN Zero benchmarking initiative.

The exercise revealed huge variation in the greenhouse gas (GHG) emissions across farms. The highest carbon footprints were associated with a greater reliance on artificial nitrogen – rates on farms with the highest figures measured some 212kg/ha compared to 165kg/ha with lower GHG intensities.

Nitrogen fertiliser contributes more than half of a wheat crop's carbon footprint, so growers should tackle this by improving nutrient use efficiency, says Christine Baxter of Adas. "Measure levels of mineral nitrogen in the soil, only apply what the crop needs and optimise application timings," she advises. "Using inhibitors is appropriate with some fertiliser products."

Moving from a plough-based system to a direct drill gave a 9% reduction in a crop's carbon footprint, while legumes had the lowest crop carbon footprint of 600-800kg carbon dioxide equivalent (CO_2e)/ha. The average carbon footprint of a winter wheat crop grown for the feed market was 2,724kg CO_2e/ha.

"Little things can all help, but the combination of reduced tillage, cutting crops when dry and optimising fertiliser use gave a really good reduction in the carbon footprint, without losing valuable crop output," she says.

ACTION POINTS FOR ARABLE FARMS

Crop production

- Reduced tillage/zero tillage
- Leave crop residues on soil surface
- Soil amendments
- Use cover/catch crops

Nutrient/soil management

- Measure/monitor soil organic matter
- Dig a hole to look at soil structure
- Use nitrification inhibitors
- Biological N fixation in rotations through growing legumes

Other

- Baseline your carbon footprint
- Prepare nutrient management plans to avoid excess and deficiency
- Consider renewable energy options
- Integrate agri-environment schemes
- Maximise natural capital on the farm

"One of the things that can make a huge difference is to look at how long tractors spend idling," she says. "The figures will shock you, but they are easily reduced."

The fuel use per hectare figure is one of the KPIs on Farm Carbon Toolkit's calculator, so it's easy to track how it's changed. "When looking at actions to reduce emissions, aiming to cut fuel use by 10-15% is a great place to start."

Cultivations policy should also come under scrutiny, not just for the carbon losses that can arise from soil disturbance and reductions in organic matter, but also from wearing parts. No-till will not suit every farm situation but does offer useful fuel reductions and soil carbon benefits.

"Arable farming involves a number of passes, some of which could be eliminated or combined – particularly if input use reduction is the aim. Harvest is another hotspot when it comes to fuel use, minimising the time machinery is left idle on the headland or in the yard can save a lot of fuel.

"Each year is different but it is also worth considering the fuel use associated with grain drying." At current fuel prices, growers should do the calculations to see whether its cheaper to buy more fuel and increase emissions or to take a moisture penalty, she says.

Future goals

For most arable farmers, the goal must be to have a balanced farming system that can still be highly productive, as well as sustainable.

"Look after your soils and minimise any damage that's done to them," recommends Ms Adams. "Recognise that from time to time they can still be a source of carbon emissions, as all systems tend to have periods of decline.

"If the organic matter and, consequently the amount of carbon stored within the soil profile, is decreasing over time, this will be counted as an emission on your carbon footprint."

While soils represent a huge opportunity for sequestration through capturing and storing carbon from the atmosphere, focusing on soil health and quality will bring agronomic benefits to the farming system, through processes such as nutrient cycling, water storage and overall fertility.

"When measuring your soil organic matter content, the actual figure is less important than the direction of travel. If it's going up, that's great," says Ms Adams. "If you look after your soil, it will look after you."

Other areas for arable farmers to exploit when it comes to reducing GHGs include renewable energy, woodlands and diverse rotations. "Opportunities to increase sequestration will vary according to the site, but the goal is to get the system in balance, so that emissions and sequestration are equal," she says. ■

GREENHOUSE GAS EMISSIONS: THE THREE SCOPES

Emissions are categorised into three scopes, which are then combined to give a total farm emissions figure.

Scope 1 Direct emissions – such as from tractors, heating, land use change, manure storage and application.

Scope 2 Purchased emissions – associated with the generation of purchased electricity used on the farm.

Scope 3 Indirect emissions – associated with the use of inputs in a farming system, as well as embedded emissions in machinery and buildings.

TRANSITION FARMER PHILIP VICKERS

A carbon footprinting exercise carried out before Philip Vickers became farm manager at Raby Estate in County Durham confirmed that nitrogen fertiliser was the main culprit in terms of the farm's total greenhouse gas emissions.

Given the nitrous oxide emissions associated with its production and application, Mr Vickers has plenty of ideas about how to reduce the estate's reliance on bagged nitrogen and has already brought application rates down and made use of alternatives.

"Reductions are achievable," he says. "This year, we used the lowest ever rate of nitrogen on our oilseed rape but achieved the highest yields. We may have mined some soil reserves in such a dry winter, but it showed that there is scope."

Likewise, the estate's 2022 spring barley crop received just 80kg/ha of nitrogen, with organic manures also being used to supply some of its nutrient requirements.

While he admits that the desire to save fertiliser stocks for next year helped with some of the decisions, Mr Vickers suspects that over-application may have featured in the past when fertiliser prices were lower.

As a result, close monitoring and targeting of nitrogen fertiliser is now carried out to ensure that it is matched to crop need and applied in optimum conditions.

"We know that the efficiency of nitrogen fertiliser use isn't very good across the industry, so everything that we can do to improve this figure is worthwhile – especially given current prices and availability issues."

For the first time ever, manures were applied to growing winter wheat and barley crops in the spring of 2022. "Having never done this before, the idea filled me with dread," he recalls. "We used an experienced contractor with very big kit, and although we could see where he had been, there was a yield benefit."

Getting hold of manures in 2023 could be a problem, he anticipates, as the avian flu outbreak has affected the supply of poultry manures and others are worth much more than they used to be.

Otherwise, he is keen to investigate composting as another way of supplying nutrients and is interested to hear from other farmers in the north of the country having success with the technique.

In terms of other greenhouse gases, fuel use has come down with the move to a regenerative system and cultivations have reduced, helping to lower carbon dioxide emissions.

"We know where we should be targeting our efforts, so we can continue to make progress with emissions and reaching net zero," Mr Vickers adds.

● **Follow Philip Vickers and our other Transition Farmers as they adapt their business for the new environmental schemes and phase-out of the Basic Payment Scheme. Find out more on p5**

GARY NAYLOR, RABY ESTATES

GARY NAYLOR PHOTOGRAPHY

AHDB

To find out more
Call 024 7669 2051
Email mark.topliff@ahdb.org.uk
Visit ahdb.org.uk/nitrogen-calculator

Does it pay to reduce nitrogen fertiliser?

With no short-term prospect of fertiliser prices falling, farm economics analyst Mark Topliff explores the full cost of reducing nitrogen fertiliser application.

When it comes to nitrogen fertiliser, is less, more? Or do you get out what you put in? The question has long since been pertinent for farmers and growers across the country, but with its increasingly significant contribution to on-farm costs and greenhouse gas emissions, it is more critical than ever.

In the last 12 months, imported ammonium nitrate (AN) fertiliser prices have risen by a staggering 120% and fertiliser products such as diammonium phosphate (DAP) have nearly doubled in price.

Unsurprisingly, in response to these sky-rocketing prices, many farmers and growers have chosen to reduce application rates to cushion the financial blow. And with data showing that even with a 10% reduction in application rate, costs in 2023 are to be more than triple those in 2021, the same is likely for this growing season.

So how does reduced application affect yields and subsequent profitability? AHDB data demonstrates there may be no clear relationship between application rates and yields, but there is a balance to strike.

AHDB Farmbench user data shows that for conventional first winter feed wheat on clay loam soils, a typical application rate of 220 kg N/ha results in yields ranging between 6.5t/ha and 12.5t/ha. Furthermore, Farmbench figures also reveal that the top 25% of first winter feed wheat achieved higher yields with less inorganic nitrogen per tonne of grain produced - although this group did have a higher use of organic fertiliser.

By crunching the data to better understand the variations between scenarios, AHDB is able to help levy payers use nitrogen more effectively, reducing greenhouse gas emissions and optimising on profitability.

Fundamental to finding this economic optimum is calculating the breakeven ration or BER, this is the extra yield needed to pay for one kilogram of nitrogen fertiliser and are the foundation of AHDB's Nutrient Management Guide RB209.

The BER is unique to each situation due to fertiliser costs and grain prices and based on current prices, the typical BER for cereals is around 9.3:1 – 9.3 kg of grain needed to pay for 1 kg of nitrogen fertiliser, and around 4.6:1. for oilseeds.

To enable levy payers to easily make this calculation for their unique situation, AHDB has developed a calculator to estimate the BER. It also suggests an adjustment to the RB209 recommended nitrogen fertiliser rate.

Straight forward to use, simply enter the fertiliser price and the nitrogen content, along with the grain or oilseed price. Additionally, enter your typical application rate and crop area for more results on the nitrogen requirements for your situation.

Here's a demonstrative example: If AN fertiliser is £870/tonne, winter feed wheat price is £265/tonne and RB209 states a BER, the recommended reduction in nitrogen would be 45 kg/ha (saving £113/ha) and the estimated yield reduction would be 0.31 t/ha (losing £85/ha). The difference between cost saved and income lost is a gain of £28/ha, making it cost effective to reduce inorganic nitrogen fertiliser rates in this situation.

Livestock producers can also benefit from this specialist analysis by using the dedicated grassland calculator.

To gain a better understanding of the price trends of fertiliser, AHDB's fertiliser prices webpage aims to bring transparency to the market and help levy payers gain better understanding of the cost on this key input.

Mark Topliff

HARVESTING YOUR ENERGY RESOURCES

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In today's world, diversifying into energy is a way of making sure your land is working for you, the climate and society

From government agricultural policies, subsidy schemes, Brexit to supply chain issues, the only constant in the farming sector is change.

That's why so many farmers and landowners are using energy assets to diversify income away from traditional crops and livestock. As well as leasing your land for energy projects such as solar, Conrad Energy can assist with:

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At **Conrad Energy** we work with landowners of all sizes, bringing value to their own energy projects through PPAs. These agreements are usually for a fixed price one- to two- year term and can be put in place for wind turbines, anaerobic digestion, ground and roof mount solar and hydropower.

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Using waste from your farm, an AD plant can produce gas to be injected into the gas grid within the new Green Gas Support Scheme or generate electricity for export into the grid.

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Battery storage allows you to buy and sell energy to and from the grid, and benefit from other services that help keep the lights stay on. There are two main revenue streams:

- Charging the battery when prices are low and discharging it when they're high to help store renewable energy and balance the grid
- Providing grid services. Batteries are great at providing fast frequency response to help stabilize the grid.

We build long term relationships with our landowners

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Talk to us today about harvesting the potential of your energy.

Energy diversification

At **Conrad Energy** we know our way round both farms and energy assets. Let's work together to grow your business.

Green capital will fuel our future

TIM SCRIVENER

Farmers and the environment will benefit from work to achieve net zero, says **Joe Stanley**

The year 2040 may seem a long way off. But it will soon come around and, by then, UK agriculture should be approaching our collective net-zero target set by NFU president Minette Batters at the Oxford Farming Conference in 2019.

The NFU represents some 60,000 UK farming businesses, and there remains a good deal of scepticism, even among its members, about this ambition. But the reality is that the UK government has already enshrined a national target of 2050 in law.

As farmers, we will increasingly come under pressure to demonstrate a climate-neutral direction of travel. Not just from the government, but also from consumers, retailers and the banks and insurers with whom we do business.

Soon, consumers will eschew high-carbon products; banks will charge more interest to businesses with no plan for emissions reductions; and downstream businesses will require carbon insetting as part of any commodity contract.

In addition, climate change is already wreaking havoc: we must decarbonise because the alternative is unthinkable. So what can a simple farm business do? There are two types of carbon accounting on-farm: those related to our emissions and those to our ability to sequester.

Decarbonisation

It might be tempting to think that we can sequester our way to net zero, and perhaps some farms can – some low-input graziers, especially in the uplands, may already be demonstrably in a carbon-negative position.

But for the majority, a huge element of farm decarbonisation will by necessity come from the reduction of emissions, or contribution to renewables generation.

It is worth considering that some 75% of the average UK arable farm's emissions come from its fertiliser applications, while a similar percentage of the average livestock farm's come from the livestock themselves and their manure.

Nationally, we only sequester some 2% of our annual emissions across all land-use types, including forestry; even if farmers claimed this entire amount for ourselves, that's currently only offsetting 20% of our own emissions: we're a long way from saving the world.

At the Allerton Project, we're devoting much time to researching how farms can reduce emissions and how we can sequester more carbon on-farm both in biomass and soil. One flagship project is our long-term conservation agriculture trial in partnership with Syngenta, now entering its sixth year.

Across a five-field, four-crop rotation, we are comparing the difference between continuously ploughed, min-tilled and direct-drilled scenarios on our heavy clay soils.

Despite overall yield reducing by some 8% across the rotation, our overall net profit/ha is improved by 19% as a result of significant 47% fuel-use reductions, an increase in work rate of some 48% and a reduction in operational costs of 10%.

We have also seen a reduction in soil greenhouse gas emissions of 20% between the two systems. Results on a lighter-land comparison site have been even more favourable, with an increase in profit per hectare of a remarkable 36%.

Simultaneous research elsewhere at the Allerton Project is also demonstrating a 10% increase in soil organic matter after a decade within a "conservation agriculture" system – one without the turbocharge of significant volumes of manures being returned to it.

Promising findings

Together, this is very promising data demonstrating the dual benefits to such a system of both reducing emissions and sequestering more soil carbon, while making more money.

Even if farmers are not of a desire to "trade" in soil carbon credits (and who would blame them in the current marketplace?), the benefits of increasing soil organic matter are reason enough to make the journey, essential as it is to soil productivity, health and structure.

For example, we can demonstrate a straight-line correlation between organic matter levels, compaction and water infiltration and storage.

Hedge funds

In other green capital, the Allerton Project is currently developing a Hedgerow Carbon Code, which from next year will sit alongside the Woodland and Peatland Carbon Codes as quality-assured schemes backed by government.

In England alone, 550,000km of hedgerows store some 9m tonnes of carbon worth £65m at today's base price. Although additionality will be key in unlocking future payments, soon hedges managed for both biodiversity and carbon may start to provide a valuable income stream to many farms, helping cushion loss of direct payments and the poorly funded Sustainable Farming Incentive.

On the livestock front, we are conducting trials into the feeding of willow leaves to ruminants, which are showing great promise in reducing the amount of volatile and polluting nitrous oxide, carbon dioxide and ammonia in their urine, while also showing benefits for intestinal health.

Alongside our work on deep-rooting grasses and diverse herbal leys and their potential to sequester more carbon, deeper into the soil profile, we are hoping to demonstrate that nature-friendly, sustainable and profitable food production can exist side-by-side in a thriving rural landscape. ■

● **Joe Stanley is head of training and partnerships at the Allerton Project. For more details, visit allertontrust.org.uk**

SUPPORTING

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Five ways producers can cut their carbon footprint

Reducing greenhouse gas emissions from livestock can make good business sense. **Jonathan Riley** reports

ANTHONY BROWN/ADOBE STOCK

Cutting the livestock sector's carbon footprint has been high on the climate change agenda for years. But farmers should thoroughly review their key performance indicators before taking any necessary steps, says Jude Capper, ABP chairwoman of sustainable beef and sheep production at Harper Adams University.

This should include age at first calving and growth rates. Without knowing how the business performs, it is impossible to make informed decisions and chart progress, says Prof Capper. Based on the findings, producers can then adopt a range of steps – some simple and some more strategic.

Areas where changes might be made are likely to include: optimising output, feed and grazing, slurry and manure, fuel and energy, genetics and breeding.

1 Optimising output

Achieving optimal production can significantly cut a farm's greenhouse gas emissions. Prof Capper explains that optimal means a balance of maximising output within the tightest management timeframe possible while still hitting quality targets.

Reduce days to slaughter

On a beef finishing unit, for example, cutting the days-to-slaughter figure will reduce the emissions from each animal by up to 25%. But it does not simply mean sending stock to the abattoir earlier. Instead, it means improving management procedures to hit target weight and carcass specifications at the earliest opportunity. No stone should be left unturned in a bid to achieve this.

Work from the breeding stock upwards and select animals that work best within a particular system to meet the finishing or production goals. The selection process should be imposed rigorously, always retaining the best animals and letting go of any underperformers.

For dairy farms, efficiency can often be improved by using sexed semen to produce beef-breed, bull calves and heifer replacements from the best cows, says Jonathan Foot, head of environment at the AHDB.

Beef from dairy farms generally has a lower carbon footprint. This is because the cows have a dual output meat and milk – to set against their emissions.

Maintain health and welfare

Excellent health and welfare go hand-in-hand with improved productivity. Good hygiene and carefully worked vaccination programmes will help to avoid any setbacks from disease challenges early in life. This has a bearing on days-to-finish for meat animals and achieving the target age at first calving of 22-24 months for heifers.

Rearing a heifer to calving at 24 months emits about 3,700kg of greenhouse gas emissions, but this increases by almost 100% (7,290kg) if age at first caving extends to 40 months of age, says Prof Capper.

Better health and reduced stress also have a bearing on fertility with better in-calf rates. This reduces the number of unproductive days when an animal is causing emissions that add to the carbon footprint calculation without having milk or meat output to offset it.

Finally, the 2020 Centre for Innovation Excellence in Livestock (Ciel) *Net Zero Carbon and UK Livestock Report* stated that ill health results in higher carbon footprints. Bovine viral diarrhoea (BVD) can increase suckler beef's carbon footprint by as much as 130%. Prof Capper and Dr Foot both suggest calling in expert help to look at ways to improve efficiencies. Working more closely with your farm vet, for example, can often improve the herd health plan.

2 Feed and grazing

Feed is a significant factor in a farm's carbon footprint, says Dr Foot. It is particularly high in the pig sector, where about 80% of a unit's carbon footprint can be attributed to feed. Estimates for poultry units are similarly high. On >

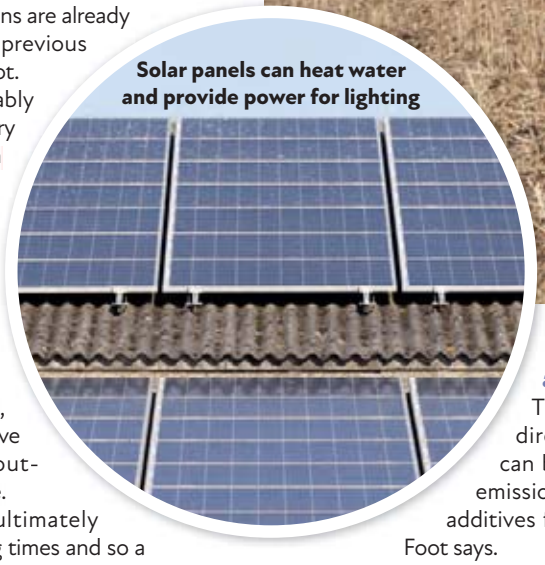
< dairy units, the contribution of feed accounts for about 28% of the footprint, while for beef and lamb the figure is far lower, at about 6%.

The reason why feed incurs a heavy cost is often down to soya meal, which is mostly imported from the US, Canada and Argentina. Carbon calculators are weighted heavily against the ingredient, particularly when associated with deforested land.

Consider alternatives

Switching to alternatives such as pea protein or co-products such as biscuit meal can dramatically cut carbon. Products are often calculated as having a lower carbon cost because the majority of the emissions are already accounted for under previous processing, says Dr Foot.

The use of sustainably sourced soya meal is very attractive given its high levels of protein and relative cost. However, farmers can seek to optimise the use of their own home-grown forage, which can have multiple benefits for profitability and emissions, providing it doesn't have counterproductive outcomes on performance.



Solar panels can heat water and provide power for lighting

Alternatives may ultimately lead to longer finishing times and so a poorer carbon footprint overall. It is, therefore, vital to consult a nutritionist before making a move. It is equally important to ensure that all ingredients have been analysed, especially forage. Most bought-in feed will have been tested but forage is often fed by quantity rather than its nutrient contribution.

Analyse regularly

Having an accurate picture of forage quality allows a balanced ration formulation. It is possible that analysis will reveal bought-in feed could be reduced or different ingredients could be used to boost production performance and cut emissions overall. With silage, analysis should be carried out regularly as progress through the clamp continues or when bales from different areas of the farm are opened up.

Cut waste

Good clamp and bale management will also help cut emissions. Poorly compacted silage or loose clamp covers and damaged bale wraps will allow fermentation, causing waste, performance drops and higher emissions.

Across all feed types, allowing feed to deteriorate in clamps, bins, silos or bales will raise the carbon footprint. Wasted feed adds huge pressure when carbon from the entire production cycle of the ingredient is accounted for.

Grazing management is another factor to consider. Again, greater efficiency is the key, and tightly managed systems such as mob grazing can extract the maximum value from grassland.

Consider additives

There are also more direct actions that can be taken to curb emissions using in-feed additives for ruminants, Dr Foot says.

Methane-cutting additives are already commercially available – or about to reach the market. They include Royal DSMs 3-NOP and Harbro's Rumitech. Harbro's product uses essential oils to alter the balance of rumen microbes away from those responsible for producing more methane. Trials of the product have shown methane output for each litre of milk can be cut by 17.7%. The improved microbiome enhances digestion and leads to further performance benefits.

3 Slurry and manure

In the past, farmers would have spread livestock slurry and manure according to the calendar or when storage capacities were reached, says Prof Capper. But this approach leads to higher emissions and wastes a potentially valuable resource, she says.

Instead, slurry and manure management should be viewed as an opportunity to cut emissions at spreading and as a valuable resource. This should be both in terms of reducing the amount of additional fertiliser needed and improving soil quality, says Prof Capper.

Analyse stocks and soil requirements

As with feed, it is important to analyse soil to ensure that any applications are carefully tailored to requirements, she says.

Dr Foot's team at AHDB is responsible for updating and managing the nutrient management guidance document RB209. This should be used to devise a nutrient management plan that includes soil testing and analysis of the organic materials to be applied. Dr Foot says farmers can use an agronomist to help them optimise management plans.

Switch to direct applications

The method of spreading is also key to cut the farm's emissions, says Dr Foot. Trailing hose or direct injection equipment can cut emissions by more than 70% compared to splash plates.

In some parts of the UK, splash plates are already outlawed. But where they continue to be used, slurry must be worked into the soil within 24 hours to reduce emissions, he says.

Upgrade and cover stores

Having enough storage is key to optimising management of slurry applications and cutting emissions. With storage capable of holding about six months' worth of slurry, farmers have greater opportunities to select dates when plant uptakes are at their greatest and soil is in an ideal condition to cope with traffic, says Dr Foot.

Cover stores

Ammonia, nitrous oxide and methane are produced by anaerobic actions in the slurry and pass into the atmosphere.

Putting a lid over slurry stores will dramatically reduce these emissions.

According to Defra figures, ammonia emissions can be reduced by 70-78% using a cover. For nitrous oxide the figure is higher still at 91%.

A range of covers exist to reduce losses according to the AHDB. Types of cover include relatively low-cost, permeable materials, such as:

- Chopped straw mulch
- Expanded clay aggregates
- Foam glass
- Floating plastic plates.

Alternatively, permeable plastic membranes that also keep out rainwater could be used,

TIM SCRIVENER, OUR COW MOLLY

With tanker slurry spreading systems, less machinery – and therefore fuel – is needed

but costs for this method of containment can be high.

For tanks, options range from free-floating plastic covers with a lower cost, to PVC-reinforced fabric covers that can be fixed in place. Fixed covers require support poles and attachments to the tank. Where additional work is required, these can incur the highest cost.

Consider additives

Like feed, there are direct solutions to reducing methane in slurry via additives. Research has shown that it may be possible to reduce total emissions from stored slurry by 90%.

The method alters the pH in tanks, making the slurry more acid and changing the microbacteria present. In trials, methane production was reduced by 67-87% and ammonia by up to 95%.

Inoculation with an antimicrobial that targets the anaerobic bacteria-producing methane has also been effective in trials. Methane output was cut by 72%.

Use multi-herbal leys

Drilling red clover and multi-herbal leys is an alternative method for reducing reliance on slurry and bought-in fertiliser, suggests Prof Capper. Nitrogen-fixing plants can contribute significant quantities of nutrients to the soil – in some cases, halving the use of artificial fertiliser requirements.

Multi-herbal leys also yield more biomass in the ley and lead to better feed intakes. This boosts efficiency without resorting to buying extra concentrate.

4 Fuel and energy

Fuel is a major contributor to emissions from indoor pig and poultry units, accounting for about 10% of their greenhouse gas output. For most other livestock units, the contribution of fuel is far lower.

Undertake an energy audit

Dr Foot suggests using an energy audit. Identifying areas of high use will allow producers to adopt a strategic approach to fuel use, she says.

For example, it may be possible to alter routines so vehicles can combine tasks, or a smaller, more efficient mode of transport could be used.

Switching to contractors with more appropriate, more fuel-efficient machinery to carry out field work may also cut emissions.

Invest in renewables

Renewable energy sources can help offset the use of fossil fuel-derived power. In dairy parlours, water heating could be serviced by solar panels or heat pumps.

Swapping to LED lighting in housing and cattle sheds can reduce electricity use by 80%. The change in spectrum has also been shown to improve production performance in dairy cows and health and welfare in indoor pigs.

Another alternative to cut emissions from slurry is to install an anaerobic digester (AD) plant. This dramatically cuts emissions and produces renewable energy to heat buildings and so further cuts the farm's carbon output. It is, therefore, well-suited to indoor pig or poultry units. The AD plant also yields digestate, which can be used as fertiliser, reducing the need for bought-in nitrogen.

5 Genetics and breeding

Long-term solutions to cutting emissions at source – the animal itself – are developing fast. Launched in 2021, the AHDB's EnviroCow venture is a genetic index that links lifespan, production, fertility and a feed conversion to reflect an animal's likely carbon footprint.

The scale from -3 to +3 highlights the sire's potential to pass on genes that govern its daughters' environmental credentials. The most efficient cows consume 400kg less food during a lactation to produce the same amount of milk. Selecting for this trait alone will significantly cut feed use and reduce the farm's carbon footprint.

Another development in the pipeline is the potential selection of ruminants on their methane output. Methane emissions are linked to the amount of saliva produced and this trait is heritable, researchers have found. Early trial results suggest that selecting animals that produce less saliva leads to a 40% cut in methane output.

A more direct approach to cutting methane is a mask produced by the Zero Emissions Livestock Project (Zelp), says Dr Capper. Although not yet commercially available, Zelp masks have proved to be a successful method of tackling ruminant methane output in trials. The masks attach to the animal via a head strap, and have flaps that extend over the nostrils.

A catalyst within the flaps then neutralises the methane as the animal breathes out. The venture has won significant financial backing, speeding up development. It is hoped they will come to market in the near future. ■

TRANSITION FARMER EDDIE ANDREW

Transition farmer Eddie Andrew is weighing up two renewable energy options to cut emissions on his Yorkshire dairy farm.

The ice cream maker says the options of either solar panels or a slurry-fed anaerobic digester (AD) plant will help protect the business from volatile energy prices by meeting the farm's total power needs. Mr Andrew is researching the pros and cons and looking into potential funding schemes to offset the capital costs of purchase and installation.

Although the farm already has solar panels, possibly making it a simpler choice, Mr Andrew has concerns over the reliability of supply. Most farms with solar panels need diesel generators as backup on darker, cloudier days. That would require purchase of fossil fuel prevent the farm going off-grid.

Bioelectric AD plants, on the other hand, are specifically designed to convert slurry into clean energy and create a constant supply of power. A further benefit is the resulting digestate is a more potent fertiliser so could cut bought-in nitrogen, he explains.

● **Follow Eddie Andrew and our other Transition Farmers as they adapt their business for the new environmental schemes and phase-out of the Basic Payment Scheme. Find out more on p5**

To find out more
Email farming@morrisonsplc.co.uk
Visit www.morrisons-farming.com/how-we-work/environment-sustainability/

Our Journey to Net Zero: An Update

In March 2021, Morrisons announced our ambition to be supplied by a Net Zero British agricultural supply chain by 2030. Since then, we've been working hard to make this ambition a reality, and we're working with the most innovative brains in the industry to find new solutions to on-farm challenges with reducing emissions and increasing sequestration.

So far, our hard work has resulted in some very positive steps forward on the journey to more sustainable farming practices.

We recently became the first supermarket to launch our own line of carbon neutral eggs - Planet Friendly Eggs - which come from Morrisons supplier farms where hens are fed a soya-free diet of insects, which are in turn fed on food waste from our own bakery, fruit and vegetable sites. This pioneering 'circular waste' feeding scheme, powered by Better Origin technology, reduces deforestation caused by soya production, and negates the carbon emissions from transporting this soya. The egg farm supplying the first stock of Planet Friendly Eggs also has a large wind turbine, 50 kWh solar panels, and a carbon sequestration programme to offset any remaining emissions on the farm - with 20 percent of the land planted with trees.

To support more farmers with the sometimes daunting prospect of planting trees, we have also employed a team of 'Tree Advisors'. This team is giving specialist advice to UK farmers on the best species of trees to plant, where to plant them, and how to manage their woodland in order to have the best environmental effect, without impacting their farm business. Our advisors - based at the Forest Canopy Foundation, and funded by Morrisons - will work with our farmer network to plant the right trees in the right place for the right reasons, to gain government and grant funding to cover costs, and bring additional income from woodland projects.

Earlier this year we announced the launch of our Sustainable Beef and Lamb Scheme to recognise, help and financially support farmers working to help the environment. The scheme will offer livestock premiums, green discounts, subsidised audits and free environmental advice to reward farmers for key activities such as:

- Reducing carbon emissions
- Sourcing greener feeds
- Putting measures in place to become land and nature positive (e.g. improving biodiversity or soil health)
- Becoming animal and enterprise positive (e.g. focussing on aspects like herd health and protecting family farming).

For more information about the Sustainable Beef and Lamb Scheme, please contact livestock buyer Jessica Tomley: jessica.tomley@morrisonsplc.co.uk

As part of our research work looking at innovative ways to reduce emissions, we're also working with Queen's University Belfast looking at the use of seaweed from the UK in helping to reduce methane production in cattle. Led by Professor Sharon Huws and Dr Katerina Theodoridou of the Institute for Global Food Security (IGFS), is testing indigenous seaweed from the Irish and UK coastlines. The aim is to evaluate the nutritional value of seaweed and assess its potential to reduce methane emissions, improve animal health, and enhance meat and milk quality.

All of these activities illustrate just some of the work we're supporting and conducting to help the industry on the journey to 'Net Zero'. For more information, and to learn about all the different ways you could reduce your on-farm emissions and increase sequestration, visit our knowledge hub on our farming website: https://www.morrisons-farming.com/how-we-work/environment-sustainability/

The carbon trading conundrum: Risk or revenue generator?

Is agri-carbon a viable income stream for farmers? While some are understandably hesitating, a number of schemes are open for business. **Mike Abram** reports

Selling excess stored carbon or carbon associated with emission reductions as carbon credits could be a lucrative new income stream for farmers. In theory, at least. It will help other firms offset their unavoidable carbon emissions after that firm has taken all steps to reduce its emissions and achieve net-zero targets.

But the practice is fraught with controversy. Concerns, especially with soil carbon schemes, include whether selling carbon, particularly upfront, will harm a farmer's own decarbonisation efforts, and around whether schemes measurement, reporting and verification (MRV) practices are robust and accurate.

How do schemes ensure such sold carbon is additional and stored permanently? And do purchases of these credits, as the recent report from the Committee on Climate Change asked, slow down emissions reductions by businesses, which clearly needs to be the priority?

A proposed set of minimum requirements for soil carbon codes (see "Why soil carbon codes need accreditation", p25) should help bring some regulation to these voluntary markets, but any farmer should read the terms and conditions closely before entering a contract.

Recently, there are at least six soil carbon schemes active in the UK for farmers to consider. There are also others researching opportunities, such as Sward, or developing versions, including Regenerate Outcomes and various input manufacturers. Bayer's programme, for example, will connect growers with food chain companies downstream that are committed to greenhouse gas emissions reductions and want to reward farmers for climate-smart practices in a value-chain intervention.

There's Yara's Agoro carbon alliance, too, and Corteva and BASF, have similar types of programmes globally – if not yet in the UK – while Arla has recently announced a plan to reward milk producers for meeting sustainability targets.

Soil Capital carbon

Aimed primarily at arable farmers, Soil Capital's scheme paid out just under €1m (£869,000) to its first 100 farmers earlier this summer for verified carbon improvements. The buyers of the certificates are mostly within the supply chain.

Entrants enrol the entire arable operation, inputting operation and management data post-harvest every cropping year on a crop and field level into the Soil Capital platform, which calculates carbon footprints annually using the Cool Farm Tool (see more on carbon calculators, p7).

There are no compulsory practices, but advice is available through the platform. Certificates are issued for both carbon removals and emissions reductions. Farmers do not need to be net zero to participate.

After verification, farmers are paid on an annual basis. There are two pricing plans – Standard, where farmers pay £980/year and receive 70% of the final certificate sales value, and Basic, where farmers pay nothing up front, but Soil Capital takes a larger share of the final sales price. In this plan, farmers get 70% of the Standard plan sales price.

Terms and conditions cover a five-year certificate generation, with a 10-year retention period verified by satellite monitoring of maintenance of practices to satisfy permanence requirements. A 20% buffer pool of certificates is retained each >

GARY NAYLOR

year to cover if carbon is released from the soil due to more intensive cultivation. These are released and sold after 10 years if losses are prevented.

Soil Capital has a minimum floor price for certificates currently of £23/t carbon dioxide equivalent (CO_2e).

● **For details, see soilcapital.com**

Soil Heroes

Dutch firm Soil Heroes' programme has a strong focus on improving soil health, with additional payments for biodiversity, water holding capacity and, from next year, nutrient density.

There are two ways it works with farmers. One route is to incentivise farmers to implement regenerative practices on a hectare level. At a bare minimum, the farm must implement shallow or zero-till, and three to four other regenerative practices for the "Regen AG entry" level. This pays £260/ha to farmers. Greater implementation of regenerative practices in "Advanced Regen Ag" and "Regenerative Organic" levels pay £280/ha and £320/ha respectively.

Payments are made 50% up front and 50% after the cropping year and evidence is submitted. Partnerships are for five years with a yearly evaluation and a social, rather than legal, contract. The scheme is mostly targeted at companies within the supply or value chain.

The second route is a payment model for outcomes. Evidence of farm practices for each year are also uploaded to Soil Heroes, and the Rothamsted "RothC" model used to predict carbon sequestration on an annual basis, drawing on information from the soil analysis and practices.

Payments are made annually, with Soil Heroes taking 30% commission. In the Netherlands, latest payments were €50/t CO_2e (£43/t CO_2e).

In both routes, a soil analysis "timestamp-zero" is taken at the beginning of the contract at a €600 (£521) cost to the farmer, which provides actionable insights, the firm says. This is repeated after three to five years.

The firm says additionality is through the incentivisation of regenerative practices that wouldn't have ordinarily occurred, with the additional impact measured by the soil tests. There are no permanence clauses in place; agreements are based on one-year growing cycles to give farmers flexibility. However, it believes farmers who adopt regenerative practices are unlikely to revert to previous practices once they begin restoring soil health and see the benefits in better margins, more resilient and healthy crops.

Currently there is not any independent third-party validation, but it is working towards verification based on international verification company's Verra standard.

● **For details, see soilheroes.com**

Trinity Natural Capital Markets

Trinity Natural Capital Markets (NCM) scheme uses its in-house carbon and natural capital assessment tool, Sandy, to calculate the potential for generating what it says are high-quality carbon certificates, which can also be associated with biodiversity and water protection benefits. It is open to all types of farms and follows 2019

A focus on carbon sequestration should not be to the exclusion of emissions reduction

WAYNE HUTCHINSON

WHY SOIL CARBON CODES NEED ACCREDITATION

Soil carbon sequestration is only ever going to be a smaller part of the bigger picture of needing to focus primarily on reducing emissions at source to meet net-zero targets, according to Mark Reed, SRUC professor of rural entrepreneurship.

"It's important that we don't focus on carbon sequestration to the exclusion of reducing emissions, and that equally applies to the farming sector," he says.

Cash shortfall

But analysis by the Green Finance Institute suggests there will be a shortfall of tens of billions of pounds between what funding is available and the money needed to achieve net-zero and biodiversity targets in the land use sector in the UK. "To reach those targets we will need to rely to an extent on private finance," Prof Reed says.

With public funding primarily required to address market failures, de-risking and leveraging private funding through blending models to encourage the transition to more regenerative agricultural techniques is required. That has opened markets for private funding of things such as carbon sequestration, but there is a danger markets will "run amok" without proper policy and governance structures in place, he suggests.

"High-integrity markets are needed for farmers, so when they take funding they are guaranteed protection from companies asking for money back later on, if they feel they didn't get what they paid for.

"And it's also about protection for investors so they know they are getting the carbon abatement they are paying for. That's what creates market confidence and grows the market."

The creation of carbon codes can help increase market integrity, and this was the starting point of a Farm Soil Carbon project, part-funded by Defra's Natural Environment Investment Readiness Fund, led by the Sustainable Soils Alliance.

Multiple codes

Initially, the project team focused on developing a standard soil carbon code that could be used across the industry, similar to the Woodland and Peatland Carbon Codes, he says.

Minimum standards for verification include soil testing

JASON BYE

"We quickly realised there were already multiple farm soil carbon codes of variable quality in operation by private companies active with soil carbon schemes.

"That made it make more sense to develop a set of minimum requirements for soil carbon codes to meet to help farmers and investors be confident of the integrity of the credits they buy or sell."

Minimum requirements

A set of up to 18 minimum requirements covering areas such as additionality, permanence and quantification of credits, has been developed, with a further five minimum standards for measurement, reporting and verification. The latter requires soil testing to be used to either validate and improve models used to calculate carbon sequestration or quantify what is being sequestered.

"The idea is an independent, third-party body – possibly a standards body such as BSI – will accredit existing soil carbon codes against these minimum requirements. Companies meeting the minimum requirements will get accreditation and a clear sign to investors and farmers that these are high-integrity carbon credits."

Intergovernmental Panel on Climate Change (IPCC) tier 2 and 3 models.

Sandy, which costs from £588/year, calculates the baseline from current farm practices and historical management records. You can then use the tool to help develop your own plan or use its recommendations for reducing emissions or sequestering additional carbon. It will show the cost, efficiency and projected yield of the chosen plan, as well as the likely carbon credit potential.

These plans are not prescriptive, with more than a handful of practices offered. While the firm recommends practices should be followed once a contract is signed, other mitigation practices are also allowed.

Trinity NCM offers a wide range of contracts once these initial steps are completed, including forward contracts for future benefits from verified mitigation practices and spot contracts for carbon emissions reductions generated in a harvest year. The firm has invested considerably in making sure these contracts protect farmers and mitigate the risk of future disputes.

There is also an early action contract, backdated to reward farmers who adopted sustainable practices in the past five years and to avoid perverse incentives, such as benefiting from ploughing up previously long-term no-till land to gain extra carbon credits in future.

Carbon credits are calculated on an annual basis, verified by third-party auditors, and then can be sold on an open NCM marketplace by setting a minimum price, or to corporate buyers who usually set the price and criteria. It's also possible to sell credits to businesses you already deal with.

Trinity NCM takes 5% commission – a low percentage it says, due to removing unnecessary brokers, modelling companies and project developers involved in other schemes. There is a 20% buffer pool to protect against carbon reversal and Trinity offers up to 30 years durability based on a rolling 10-year retention period.

Financial additionality is checked by running a breakeven assessment based on the estimated costs to implement mitigation practices, including income foregone, and the revenue associated with the sale of carbon credits and potential savings due to the mitigation practices. Credits are only generated if you'd be making a loss without selling them.

● **For details, see trinityncm.com**

Agreena Carbon

Danish company Agreena's Carbon programme works with farmers on a field level, currently. It's aimed mostly at arable farmers, with a list of eligible crops that includes most combinable crops and non-permanent grazing. Farmers enter past practices on Agreena's platform to create a baseline, and a plan for the following year each year. There is full flexibility on how the land is farmed; the more regenerative practices adopted, the more the farmer can earn.

The programme calculates estimated emissions reductions and carbon removals using the various models, including the Cool Farm Tool (see p7). Agreena uses satellite imagery and remote sensing from recently acquired Hummingbird Technologies to monitor and verify transition practices, coupled with a soil sampling protocol. There is annual third-party verification prior to the issuing of certificates.

A 20% non-permanence buffer acts as a reserve pool in the event of carbon reversals, while there is also a 15% issuance fee to cover costs of data capture, quantification and certification. The issued certificates can then be kept, traded privately, or sold via Agreena's services in exchange for a 15% brokerage fee on the earnings when the certificates are sold.

The non-permanence buffer certificates are collated from all users to reimburse of breaches of contract. Agreena says these will never be used as revenue for either Agreena or paid back to individual farmers.

The firm has moved to one rolling 10-year contract, which farmers can opt out of at any >

JARGON BUSTER For a plain English A-Z guide to net-zero terminology, see **p39**

< time. But after the certificate issuance fees have been subtracted, a further 10% of the certificates are held back in the first three years. These are then paid in years five to 10, with all the eligible issued certificates being paid out by year-10 end. This, the firm suggests, incentivises the farmer to keep following the practices they have committed to.

Buyers of the certificates must have a communicated emissions reduction target, a plan for how they are reducing emissions and a net-zero target.

● **For details, see agreena.com**

Green Farm Collective

Led by six well-known regenerative farmers, the Green Farm Collective is using the Trinity platform to sell carbon and other natural capital benefits.

They aim to find their own buyers, potentially outside of the current options offered by Trinity NCM. They hope these will buy carbon and natural capital certificates for a premium from farmers who are striving to achieve net zero, improve farmland biodiversity and help fund environmentally beneficial work on their farms.

To join the Green Farm Collective scheme, prospective farmers must be using Trinity AgTech's Sandy to calculate carbon use and biodiversity areas, be farming in a way that enhances nature and the environment, have a minimum of 5% of farmed area for nature, using minimal soil disturbance nine out of 10 years for crop establishment, and following the five key principles of regenerative agriculture.

The collective will be selling carbon certificates created from both emissions reductions and carbon removals.

● **For details, see greenfarmcollective.com**

Future Foods

Yorkshire-based Future Food Solutions is using its experience from almost a decade of incentivising arable farmers through food businesses – including Heineken, Coca-Cola and William Jackson Food Group – to adopt regenerative practices, such as growing cover crops and switching to zero-till.

Each cover or catch crop within the project is measured for both above-ground biomass and impact on soils through analysis, with the extensive database now the basis of its calculation for prospective carbon sequestration for its Sustainable Futures Carbon Bank programme.

Aimed primarily at arable farmers, the programme only pays for carbon removals – for example, carbon being sequestered into soils – not for emissions reductions. The carbon credits are measurement-based on a field level – baseline soil organic carbon levels are set via soil analyses taken by following a thorough sampling protocol at the start and then after five and 10 years.

Growers entering the programme sign up to a flexible, discretionary land management agreement for 10 years, with advice on what to change to increase carbon sequestration, as well as maintain or increase production. Certificates are independently verified, and then issued by US company BCarbon.

Annual interim payments are made based on a conservative estimate of the carbon sequestered using the results of the nine years of cover crop trials, together with Cool Farm Tool modelling of production emissions, with about 50% of carbon drawdown retained as a buffer to cover seasonality, unforeseen rotation changes and lower than expected sequestration.

After five and 10 years, a repeat soil test is used to "true-up" soil carbon changes, which can potentially release extra payments from the buffer account. Carbon certificates are sold to both offset buyers – the first were bought by data company RELX this summer – and, in future, to companies in the supply chain.

Farmers receive 70% of the certificate selling price, with the other 30% covering the cost of soil testing, certification fees and the remote sensing required for validation, as well as Future Food Solutions commission. There's no upfront cost to entering the programme.

● **For details, see futurefoodsolutions.co.uk** ■

TRANSITION FARMER ED SHULDHAM

KATHY HORNIBLOW

An 1,800ha arable estate with a renewable energy business, JM Stratton in Codford, Wiltshire, is not participating in any carbon trading schemes currently.

But the estate's managing partner, Josh Stratton, helped to found the Environmental Farmers Group (EFG) – a farmer co-operative in the region, which aims to help its 100 paid and interested members pool their resources and capture value from natural capital, whether through biodiversity net gain, carbon and nutrient markets or via any future large-scale environmental/ESG projects.

The group has set out to find partners who would be able to trade carbon for the entire group, says Ed Shuldham, business development manager for JM Stratton. That's not without its challenges, with the group sceptical about assurances some of the platforms offer, especially around monitoring and measurement of carbon sequestration, whether the schemes do store any carbon, and the permanence of the carbon stored. "What we've found is that a lot don't seem to actually be checking," Mr Shuldham claims.

Progress in choosing a partner has been made by EFG, although no contracts have yet been signed. "One of the key requirements for our group is that any carbon trade is underpinned by proper and rigorous soil sampling. That makes the process more expensive, so either the carbon price needs to rise to make that more viable or an alternative market solution needs to be developed. Ultimately, the market recognises the value of quality, so we are evaluating their methodologies properly to ensure that our members can command a higher price for their carbon."

● **Follow Ed Shuldham and our other Transition Farmers as they adapt their business for the new environmental schemes and phase-out of the Basic Payment Scheme. Find out more on p5**

Farmers can now calculate their emissions baselines and earning potential for free

Agreena

To find out more
Call www.agreena.com
Email thomas.gent@agreena.com
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Increased profitability and resiliency available for 2023 harvest season

In addition to a dry harvest year, the geopolitical challenges of 2022 hit UK farmers hard in the agricultural inputs category. Defra recently reported a 33% inflation spike for inputs over the last harvest year, largely attributed to rising fertiliser and energy costs. With Basic Payment Scheme payments declining by 35% in 2023 compared to 2020, energy prices set to rise this winter and inflation potentially rising to 13% by the end of year, the challenges for farmers look set to continue.

With carbon farming initiatives on the rise across Europe, Agreena – the world's largest soil carbon certificate company – has now officially opened free access to its soil carbon programme, AgreenaCarbon, for the 2023 harvest season. UK farmers can now calculate their emissions baselines and second revenue potential, thereby discovering new ways to retain their profitability in the face of these economic challenges. With operations and more than 20 employees in the U.K., and serving 13 countries across Europe, AgreenaCarbon has more than 570,000 hectares under management and plans to expand into seven new countries by the end of this year.

The key to the company's success has been ensuring farmer control and flexibility in decision making. Unlike other schemes, Agreena's third-party verified and tradeable CO2 certificate ownership sits directly with the farmer, who can choose to keep them, sell them to institutional or private organisations, bundle the certificates with their crops or work with Agreena to achieve the best price. Farmers participating in the AgreenaCarbon programme receive up to three certificates per hectare, depending on the practices adopted, such as sowing cover crops or no-till farming. Depending on current market conditions, the value of certificates are selling for £20-40 each.

Benefits beyond new income streams

Not only does carbon farming provide an increasingly important additional revenue stream, the long-term benefits from regenerative agriculture practices support the farm business by decreasing fuel and labour costs, potentially reducing farm machinery and fertiliser costs.

Soils are one of the greatest life-supporting resources on the planet, but currently are falling into a crisis globally, with one-third of our precious soils degraded. Regenerative practices are being looked to by leaders and pioneering farmers across the world to support long-term soil health, with the increase of water-holding capacity of soils and cleaner water runoff being key factors. These benefits have resulted in water agencies focused on a clean and safe water supply, such as Severn Trent, partnering with Agreena.

A look ahead

Despite the 2022 heatwave, which served to highlight the unpredictability that climate change delivers, overall harvests in the UK were good, with many farmers completing the season in record time. However, the harvest for the 2023 season may well be a different story. Much will depend on input costs and the weather. What is certain is that farmers will be looking for ways to remain profitable and achieve return on investment from their crops. Carbon farming delivers that return, both in terms of a revenue stream and long-term improvements to business resilience.

AgreenaCarbon opened on 12 October 2022 for the new harvest season. Farmers can now log in to the platform for free to quickly determine their baseline and estimated calculation of the value available to them via carbon certificates. Agreena has even enhanced its programme offering to include more cultivation techniques and flexibility for each farmer's business needs, supporting the adoption pace and diversity of new practices. Learn more on how AgreenaCarbon can bolster both the bottom line and resiliency of your business by visiting www.agreena.com.

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Trading carbon and natural capital – a lawyer's eye view

Edd Johnson, partner at Roythornes Solicitors, looks at some of the considerations involved in entering natural capital agreements

When we talk about "trading" natural capital in this article, we are using a shorthand for selling products or services derived from natural capital assets.

We are talking about more than just selling carbon credits from fixing organic matter in soils; it may be biodiversity "units" through new habitat creation, nitrogen offsets generated by a wetland scheme or reductions in greenhouse gas emissions through peatland restoration.

As far as legal considerations go, there are four main areas to focus on:

- What are you selling?
- Is it yours to sell?
- How might contracts restrict other opportunities for exploiting natural capital?
- What are the implications of entering long-term contracts?

What are you selling?

This is an obvious point, but one that may have knock-on effects on your ability to enter into the proposed scheme or other schemes or trades in the future.

You may, for example, enter a privately funded, non-statutory environmental scheme, agreeing to deliver habitat creation for pollinators/watercourse protection buffers/low-till practices. In the small print there will probably be a clause that gives the buyer (funder) the right to the "outcomes".

In other words, you are being paid for implementing measures, but the buyer is buying the outcomes (additional biodiversity, carbon credits, and so on). Private woodland planting schemes may pay you to plant trees but keep the right to sell carbon credits generated by the planting.

Check what information rights you are selling. Expect, for example, particulars of scheme under one of the formal carbon codes to be made public on the UK Land Carbon Registry, and details of any off-site biodiversity net gain scheme to be publicly available. Private agreements may even give the buyer access to film on farm and post information about your project.

COLOBUSYETI/ADOBE STOCK

Is it yours to trade?

This is particularly important if land is tenanted, both for tenant and landlord. You will need to check your tenancy agreement, and scheme rules, to see whether and to what extent the consent of your landlord or tenant is needed before you can agree to a natural capital delivery project. And whatever tenancy agreements say, Woodland Carbon Code projects require the consent of the landlord where project land is tenanted, with the landlord signing up to the same obligations as the tenant (for example, to replant if trees fail).

In addition, it is a basic principle – whether in public or private schemes – that you cannot sell the same thing twice. This is complex. The government is, understandably, keen to see private funding for natural capital come into the sector. The current Defra position is that it is possible to include the same land in a Sustainable Farming Incentive scheme and a private scheme as long as you are not being paid for a similar activity or outcome on the same area of land at the same time.

THINGS TO WATCH FOR

- Restrictions in any tenancy agreement (or need for agreement from either landlord or tenant)
- What additional obligations you are agreeing to (monitoring and reporting, consent before any land ownership/occupation change)
- What rights you are granting (rights in outcomes, access rights, rights to use information)
- Interplay with other schemes or contracts you are signed up to (are you already being paid for the same actions or outcomes?)
- Taxation implications of any long-term land use change

Private schemes may have an explicit clause prohibiting double-selling and requiring you to warrant that the particular outcome you are delivering is not already being paid for by someone else.

Restricting your opportunities

This is a similar point. If you enter a 10-year, privately funded agreement to deliver carbon credits, or additional biodiversity, you may well be limiting your ability to "sell" those outcomes elsewhere. Again, this may come down to a forensic assessment of what exactly you are being paid for under a particular agreement.

It is still an emerging area, but additional carbon-reduction/sequestration incentives from direct or indirect buyers of your produce may be on offer. Or carbon neutrality may become a requirement. The bottom line is you cannot sell the same thing twice, and if you have sold carbon credits to a third party outside your supply chain, they will not be available for use within the chain.

Implications of long-term contracts

Many natural capital agreements are long term. Circumstances may change, and you are likely to be agreeing to do or not do certain things on your farm across generations. You will want to take this into account before signing up.

Check what restrictions/consents/notice is needed before transfers of land ownership or occupation can take place. Make sure the structure of your business is such that the next generation are not simply landed with liabilities, but can benefit from rewards under the agreement.

If what the agreement delivers is a change in use from agriculture, you will want to take advice on the associated tax consequences, or at least on the risk of your land not considered to be in agricultural use. On the inheritance tax front, for example, agricultural property relief may be put at risk by a full-on habitat or wetland creation scheme. ■

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The pitfalls of 'carbon tunnel vision' for landowners

One of the most frequent questions we get asked by our clients is: 'How can I measure the carbon emissions from my farm or estate?'

Establishing and understanding your carbon baseline remains absolutely the right place to start and we are doing a lot of this work for our clients. Nevertheless, by focusing solely on carbon emissions, there is a risk of suffering from what has become known as carbon tunnel vision.

The threats and challenges that the climate and biodiversity crises pose to us all are now well understood. Farmers and landowners have a unique opportunity to play their part in helping to address these challenges by making changes to land management practices that have lower carbon footprints and can bring about improvements for wildlife. From our interactions with our clients, it is increasingly clear that there is the will to do so and that there can be financial benefits too.

Carbon tunnel vision – the problem

There are several ways in which a land-based business can help to address such existential challenges, but there has been no escaping that it is carbon and reducing carbon emissions which has received the most attention.

Carbon tunnel vision (a phrase first coined by Dr Jan Konietzko from Cognizant) has become a popular description of the observation that by focusing solely on carbon emissions, we risk causing further harm to people and our planet by neglecting biodiversity and human well-being.

There are a number of relevant issues which will need to be addressed to ensure a transition to sustainability such as pollution, deforestation, resource scarcity, biodiversity loss, health, education and equality to name a few.

These are factors that many farms and estate businesses can have influence upon to some degree. They are interconnected and focusing too heavily on one jeopardises the others to the detriment of our planet and wellbeing.

Our advice to clients is to look beyond carbon emissions and consider the wider impacts and dependencies that their business has on the environment and society.

Natural capital accounting

Since 2019 Strutt & Parker, in collaboration with leading environmental economists eftec, have been helping clients do just that by helping them to produce natural capital accounts. In simple terms, a natural capital account takes a holistic view of a farm or estate to show, in financial terms, the impacts and dependencies that the business has on nature and the environment, including their greenhouse gas emissions. The account can also be used to underpin decision making by showing the effects of changes to land management and whether the changes are sustainable in the long term and explore potential new sources of income like voluntary carbon markets, Biodiversity Net Gain (BNG) credits and public money for public goods through agri-environment schemes.

We are helping landowners and farmers navigate every aspect of their natural capital obligations and opportunities.
Contact the team today to see how we could help you.

About Strutt & Parker

Strutt & Parker is one of the largest and most successful property consultancies in the UK, with offices across the country. As part of the BNP Paribas Group, Strutt & Parker brings together a unique mix of financial, property and farming expertise, together with extensive knowledge of land, forestry, renewable energy, viticulture and environmental management to provided strategic business advice and practical management services to farms, estates and a range of other landowners.

How to get a carbon-based income from woodland

JEVANTO PRODUCTIONS/ADOBE STOCK, ANDREW DALLY /ALAMY STOCK PHOTO

Planting woodland brings farms a range of benefits and opportunities. **Louise Impey** reports

On-farm tree planting is linked to diversification opportunities, extra revenue, better farm productivity and meeting wider environmental goals – with trees being able to lock up carbon and support nature recovery.

For farmers looking to make money from woodland through the sale of carbon credits, there is a recognised scheme – the Woodland Carbon Code (WCC) – that operates in the market, providing protection and confidence for both buyers and sellers.

In England, Scotland and Wales, the WCC acts as the rulebook and gives formal recognition to the potential of woodlands to soak up carbon dioxide from the atmosphere and provide a host of other benefits.

Along with the Woodland Carbon Guarantee (see "What is the Woodland Carbon Guarantee?", p32), it sets a standard and gives an agreed long-term price for the carbon accrued.

It also encourages a consistent approach to woodland carbon projects, ensuring that woodlands are managed to national standards, and addresses the key concepts of additionality and permanence.

This means that all carbon credits coming to the UK market represent permanent sequestration of carbon dioxide that would not have happened otherwise.

Carbon income

For farmers and landowners there are two ways to realise carbon income through the code. An upfront sale of future carbon via pending issuance units (PIUs) as the wood is planted is one option. The other is to wait until the carbon has been sequestered and sell it in the form of woodland carbon units (WCUs), which may take 15-25 years.

Both routes have advantages and disadvantages, so may lend themselves to different types of woodland creation projects and business structures. Either way, carbon credits can bring forward revenue from a woodland, as well as providing additional income, but they aren't a complete solution to making woodlands pay, says Ashley Hardaker, lecturer at >

HEDGEROW CARBON CODE

Farmers who want to unlock the income generation potential of hedgerows in the same way as woodland are watching the Hedgerow Carbon Code pilot scheme with interest.

The Game and Wildlife Conservation Trust (GWCT), which used grant funding to develop the new code, is hopeful that it will become the quality assurance standard for hedges.

Testing has started on three arable farms in England, with the goal of recognising the carbon sequestration and biodiversity benefits of hedgerows and finding ways to reward farmers for planting and maintaining them.

In a similar way to the Woodland Carbon Code, it will calculate and verify the carbon capture potential of hedgerows, leading to the production of carbon credits that can be traded.

As Alastair Leake of GWCT explains, the fledgling code should encourage improvements to hedgerows and provide access to a market with a potential value of £60m. "Hedges sequester carbon at twice the rate of woodland because of their three-dimensional linear structure.

"There are plenty of old hedgerows on arable farms, for example, which are no longer needed for their primary function of containing livestock, so there's no incentive to maintain them," he says.

By attaching a value to them, this could change and prompt farmers to plant, manage and restore them, he believes, helping the farming industry to reach its net-zero target. The new code also has the potential to be developed further to monitor hedgerow biodiversity, for calculating biodiversity credits for natural capital markets.

Far left: Ashley Hardaker, lecturer at Bangor University
Left: Emma Stewart, carbon markets project manager at the Forestry Commission

WOODLAND CARBON CODE – THE BASICS

To meet the requirements of the Woodland Carbon Code (WCC), woodland projects must:

- Be registered, including exact locations and long-term objectives
- Meet national forestry standards, so that they are sustainably and responsibly managed
- Have a long-term management plan
- Use standard methods for estimating the carbon that will be sequestered
- Demonstrate that they will deliver additional carbon benefits
- Maintain verification for the duration of the project.

Over time, WCC projects undergo successive verifications, the first of which happens five years after the trees are planted, with subsequent verifications every 10 years.

This involves counting the growing trees, making sure the right number and species are there and that they aren't being damaged by pests, disease or extreme weather.

There are costs associated with the code. While it is free to register with the UK Land Carbon Registry, there are one-off validation costs of £1,100-£1,400 for each project, as well as verifications costs every 10 years, of £1,600-£2,000 for every project.

< Bangor University. "There are long timescales involved in woodland creation," he warns.

"The Woodland Carbon Code is a means of bringing extra finance into woodlands, but it's important to realise that the earlier you take the money, the less it is likely to be."

Selling carbon credits early at a cheaper rate or waiting for more income in future years is an individual choice, he says, but there are risks associated with both that farmers need to appreciate.

Risk recognition

"Once you allow carbon to leave the farm, it goes onto someone else's balance sheet," he stresses. "In the push to hit our net-zero targets, that might come back to haunt you."

Carbon credits can only be used once – farm businesses can sell them to a third party to compensate for their emissions or they can use them internally to set against their own emissions, explains Dr Hardaker.

His other point is that trees can fail or die, so there is a risk of reversibility. "Climate change, wildfires and other events can be disastrous. It's not like losing a wheat crop – there are far greater repercussions from losing a woodland, especially if you've already committed the carbon."

That is a point that Emma Stewart, carbon markets project manager at the Forestry Commission, also emphasises. "You have to replant in the case of catastrophe," she says. "You can't just leave it to natural regeneration – the 'rules' are very clear on this."

She adds that there is an in-built buffer pool in the WCC of 20%, so that if something goes wrong, carbon that has been sold forward is still available to buyers. "It works by taking PIUs from every project and holding them in a central pool. It's a bit like insurance."

While there are grants and annual maintenance payments available to support new woodland creation – with the England Woodland Creation Offer being just one example – most schemes involve a hefty amount of bureaucracy.

The recent announcement that the England Woodland Creation Offer will become part of Local Nature Recovery in the Environmental Land Management scheme from 2025 means that existing agreement holders will be able to transfer into the Local Nature Recovery tier in due course, removing one of the reasons to delay tree planting.

Carbon value

In terms of the carbon market, most businesses are not required to offset their carbon emissions yet, which means it is the buyers who dictate the market price. As the market is largely voluntary, the composition of the woodland and its narrative can determine the price paid.

At the time of writing, the last auction saw WCUs achieving an average price of £23.70,

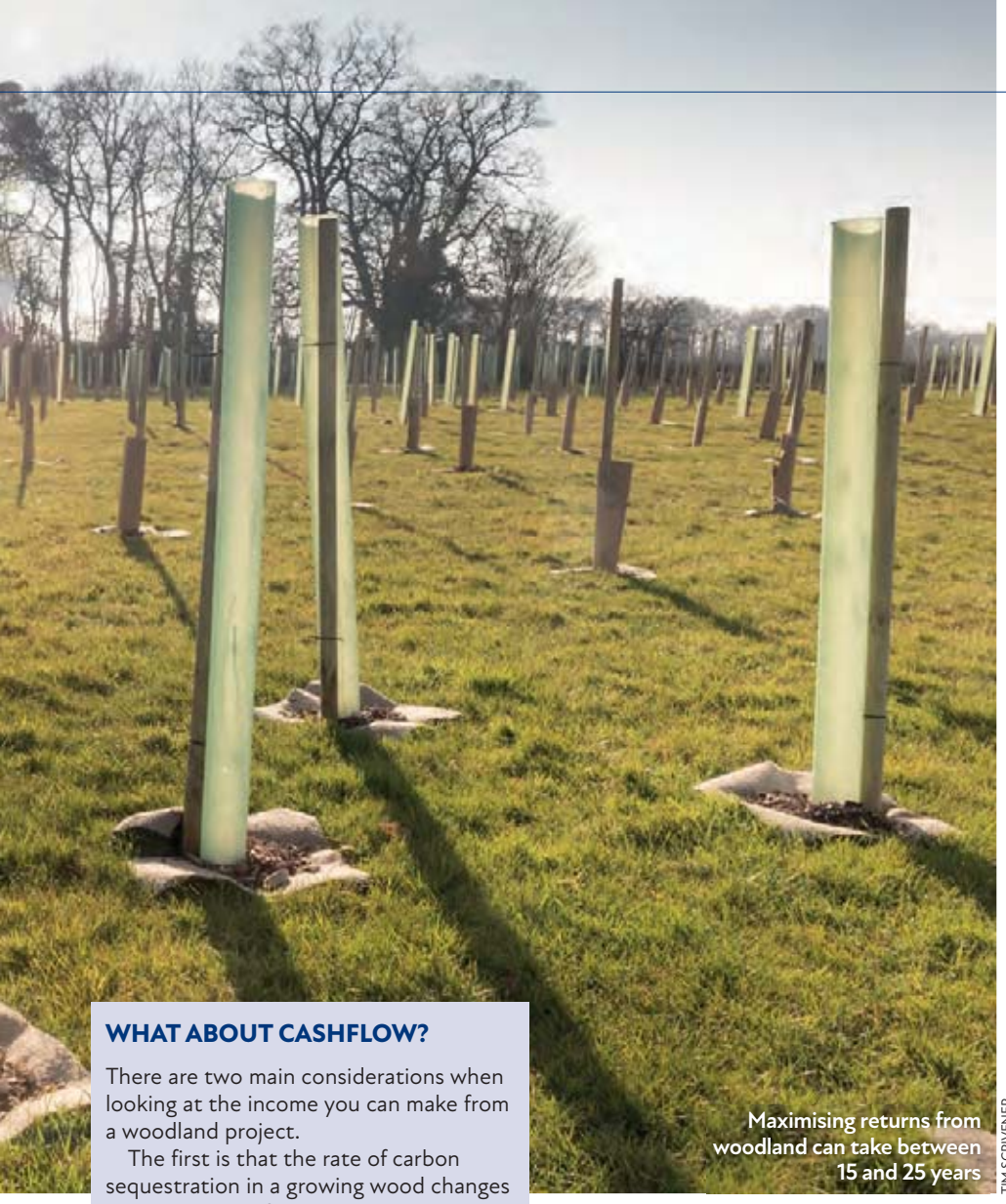
WHAT IS THE WOODLAND CARBON GUARANTEE?

The Woodland Carbon Guarantee (WCG) is a £50m government scheme designed to stimulate woodland creation in England.

Developed to ensure permanent removal of carbon dioxide from the atmosphere, in line with the government's 25 Year Environment Plan, it was introduced in November 2019 and started in early 2020.

The WCG sits within the Woodland Carbon Code framework and is one route to market. It provides farmers with the option to sell captured carbon, in the form of verified carbon credits, to the government for a guaranteed price every five to 10 years, up to 2055-56. If they prefer, farmers can choose to sell the credits on the open market, rather than to the government.

The guaranteed price is intended to give long-term certainty and is set at a level that makes investment worthwhile. Contracts are awarded through sealed bid reverse auctions every six months, and winning a contract under the scheme gives sellers the option to sell carbon credits to the government at a guaranteed price.



Maximising returns from woodland can take between 15 and 25 years

TIM SCRIVENER

WHAT ABOUT CASHFLOW?

There are two main considerations when looking at the income you can make from a woodland project.

The first is that the rate of carbon sequestration in a growing wood changes throughout its lifetime. Slow growth initially, together with soil disturbance that occurs with ground preparation, means many woodland creation projects barely break even carbon-wise by year five. After 15-20 years, the trees have laid down good root systems and are growing rapidly, with sequestration rates increasing, too.

Second, releasing income from the sale of woodland carbon units (WCUs) takes a very long time but achieves higher prices. Whereas pending issuance units can be sold upfront, most projects won't have many WCUs to sell until 15 or 25 years down the line. If you can afford to wait, WCUs can be lucrative.

while PIUs were going for £5-£8. The next auction takes place in November 2022, so expect these averages to change.

According to the Forestry Commission, prices paid vary in the private market and the value is affected by vintage, but £10-£25-plus a unit is a good guideline, with woodlands generating between 100-500 units/ha.

As one unit is equivalent to 1t of carbon, that means the total income is anywhere between £1,000-£12,500-plus/ha.

There is no minimum size of woodland to enter the WCC, but there are costs associated with the necessary validation and verification, so it may make sense to group small projects together, points out Ms Stewart.

"Usually the price for a tonne of carbon determines the economic level of woodland creation that is viable," she says. "Some projects are currently earning up to £40/t carbon dioxide equivalent, which makes most sizes viable."

Otherwise, there is funding to support a new project from the England Woodland Creation Offer, which provides a one-off payment of £8,500/ha followed by annual maintenance payments of £300/ha for 10 years. Additional amounts of up to £8,000/ha may also available for woodlands that provide wider social and environmental benefits.

The Woodland Creation Planning Grant offers as much as £30,000 towards the planning of a woodland project.

Whole farm situation

Dr Hardaker prefers to think of woodland as part of the whole farm unit, where it acts as a carbon pump that has an important role in mitigating some of the farm's greenhouse gas emissions.

As reaching carbon neutrality on farms will become very important in the next five to 10 years, he advises caution so that incomes from woodland carbon credits isn't given priority over the farm's carbon situation. "Think about what could happen if robust regulations are introduced and farms start to be taxed on their emissions. In that situation, woodland will be a really important feature."

For this reason, planting a woodland should be a complementary activity to the farming business, not a cost to it, he says. But balancing what it costs to establish with the income that can be generated from it is tricky.

"As farms make sensible changes as part of the transition process, woodland can be a useful income stream," Dr Hardaker says.

Once these changes have occurred, stable farm businesses will be providing healthy food, landscape, biodiversity and employment, all of which give a higher-quality carbon offset.

"When you can show carbon sequestration and a range of other benefits, you are likely to get a greater reward – both from carbon markets and from what it does for the rest of the farm."

Natural capital markets are in their infancy, he says, but they could also apply to woodland. "Stacking of income streams is a distinct possibility – after all, a piece of woodland ticks a number of boxes, from erosion and pollution control to flood management and habitat creation." ■

TRANSITION FARMER ANDY BASON

LEAF

A 10ha wood is being planted by Transition Farmer Andy Bason in Hampshire, with one of the farm's less productive arable fields being used for the project.

While carbon capture and biodiversity gain are possible future income streams from the wood, they weren't the main reasons behind the decision to go ahead.

Leaving the land in a better state and creating a legacy for future generations were uppermost in the owner's mind, as was the use of nature-based solutions that work for the wider landscape.

Some 20,000 trees will be planted, with 80% being native species and 20% non-native, thanks to funding from the England Woodland Creation Offer. In addition, a pond and some rides and glades will be included. The plan is for the wood to link up with other habitats, so new hedges will also be planted.

● Follow Andy Bason and our other Transition Farmers as they adapt their business for the new environmental schemes and phase-out of the Basic Payment Scheme. Find out more on p5

JARGON BUSTER For a plain English A-Z guide to net-zero terminology, see p39

Omnia Digital Farming

Planning for profit using **Omnia Digital Farming**

The launch of Omnia Digital Farming's Business Performance module offers an industry first capability for full farm rotational planning taking the guess work out of decision making.

Will Foyle
(Farm business consultant)

Scan for more information

The Omnia Digital Farming's Business Performance module uses farm data to cost out a range of potential cropping and machinery scenario's in terms of both financial and CO_2 equivalent performance.

This follows on from the 2021 launch of the Field Performance Module which provided the ability for retrospective calculation of the cost of production of field operations in both £/tonne, CO_2/tonne or CO_2/ hectare.

Why is this so significant?

British farming is under pressure to manage output in terms of production and emissions, whilst also remaining financially and environmentally sustainable.

However at the same time, planning a rotation is more complicated than ever, and no longer are growers looking at just the historical Norfolk four course or two wheats and an OSR.

Will Foyle, **farm business consultant** at Hutchinsons believes there are several reasons for this. "The economics of different crops has changed in response to fertiliser requirements. There is also a greater demand for oilseeds - all of which means rotations are being analysed more closely than ever before."

"This comes at a time when subsidies are reducing and there is a closer focus on increasing costs such as fuel and fertiliser."

"Currently demand for land use is strong such as for short term lets for roots, vegetables, maize and rye. Opportunities for third party payments from water companies funding cover cropping, the emergence of markets for biodiversity net gain and the impact of carbon are also contributing to both short and long term changes in cropping that need to be assessed."

"Alongside this, and coupled with schemes such as the Farming Equipment Technology Fund (FETF) and funding to support changes in machinery policy, growers are left doing the maths to see what is a viable option that could work for them."

All in all it's a really confusing picture. "How easy is it to look at the implications of buying a new drill on fixed costs, what is the real difference in costs and carbon if land is taken out of production and replaced with environmental schemes? How will the bottom line be affected if potatoes are dropped from the rotation."

The methodology

For each crop it is possible to build in variable costs and operations, or pull in those already defined in the virtual machinery shed within the Field Performance module, and then add in the rotation.

Income, variable costs, gross margin, fixed costs, net margin and tCO_2e are calculated per hectare, as well as over the year. Different cropping or machinery scenario's can be run alongside each other.

The data is visualised through several layers or maps, making it very straightforward and user-friendly.

For example it is possible using the Business Performance module to look at the implications of moving from a tillage-type disc drill to a direct drill across a five year rotation.

"By inputting income, variable costs gross margin and fixed costs it shows that despite income, variable costs and gross margin remaining the same over the year, fixed costs decrease using the direct drill from 27% to 22%, as a percentage of output. tCO_2e is also reduced."

However what is noticeable is that overall, net margin increases by £83/ha or £25,908/year."

"Another scenario could be to assume crop rotation and output remains the same but with different yield penalties applied for example."

So in short, it's possible using the Business Performance module to cost out any range of scenario's in terms of pounds and carbon, before implementing them on farm. This really is an invaluable exercise for any grower to undertake before making changes to current farm rotations or machinery to make the right decisions in what is currently a confusing picture.

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GARY NAYLOR, AF GROUP

Advice on planning ahead to combat ag inflation

Farmers and suppliers together will secure best prices on farm inputs. **Johann Tasker** reports

A huge increase in ag inflation has prompted renewed calls for growers and livestock producers to plan well ahead when purchasing farm inputs.

Farming input costs jumped by 34.15% in the year to 30 September, according to the latest AgInflation Index published by the farmer-owned AF Group. The annual increase exceeds an increase of almost 22% recorded last year.

Seven of the nine farm input categories measured by the index have seen double-digit inflation. The greatest increases were in the price of fertiliser (133.8%), fuel (42.8%) and animal feed and medicine (36%).

No farming enterprise has avoided double-digit inflation. The highest cost increases were seen by cereal and oilseed rape growers (40.1%), potato producers (39.7%) and dairy farmers (36.9%). Beef and lamb producers saw a 34.8% cost increase.

Order early

AF Group chief executive David Horton-Fawke urges farmers to work with suppliers in a bid to secure the best input prices. Good communication at an early stage and accurate forecasts of likely input requirements was important, he adds.

"The more notice we have, the more time we have to procure inputs for members at the best possible price. This is the end of just-in-time farming – we really have to plan ahead and look at the 'what ifs'.

"We are urging our members to plan their cashflows and use our index to work with processors and advisers to confront these brutal facts, because business as usual in 2023 is not going to be an option."

Energy was a particular challenge, says Mr Horton-Fawkes. "Electricity prices have virtually quintupled. Although we have the benefit of the government's energy price cap, which is very welcome, prices are still probably double what many farmers have been paying."

Latest indications suggest the price cap will be lifted in April 2023. Although ongoing political and economic instability – including pressure on public spending and the value of sterling – means that could change.

"The energy price cap will provide only temporary respite because the cap is limited and is not an open-ended commitment. Farmers are tough and resourceful and we've all had our fill of doom and gloom, but no one can afford to ignore these results."

AF Group chief executive David Horton-Fawkes

Serious challenge

The end of the price cap would have a huge impact on farm businesses and agricultural suppliers, says Mr Horton-Fawkes. "We've no idea where it could go. But if it goes back to where it was, it's going to represent a very serious challenge."

Farmers should consider any likely adjustments – including using less fuel – if the price cap ends, he adds. "On our own farm at home, we have gone through every single cost line and asked ourselves: 'What can we do to reduce it?'

"I had a call from a farmer the other day whose >

< accountant had asked whether he had sold off some of the machinery because the farm fuel bill had reduced by 30%. The answer was: 'No, we haven't. We've just been extremely disciplined about the way in which we've used our machinery'. Not everybody has that flexibility – but there are incremental gains to be had by looking at everything in detail."

Some farm input costs have risen much less than others. They include farm labour (6%), contract and hire (8.7%), crop protection products (13.3%), and machinery and plant hire (25.4%).

As a not-for-profit co-operative, the AF Group is working as closely as it can with farmers and suppliers, says Mr Horton-Fawkes. Some distributors are offering deferred payments but it is not always possible to extend credit deadlines. ■

AG INFLATION POSES BIG CHALLENGE FOR FARM SUPPLIERS

Market volatility is affecting farm input availability and pricing across a number of sectors – including fertiliser, animal feed, seed and crop protection. This is especially the case where inputs are imported.

"The real challenge we have is energy and that probably won't come as a surprise," says Ed Barker, head of policy at the Agricultural Industries Confederation, which represents 230 farm suppliers and £8bn of farmgate turnover. Uncertainty over longer term prices means suppliers are still trying to get to grips with where their energy costs are likely to sit next year.

"While we really welcome the thrust of the scheme to effectively place a cap on costs, suppliers and energy brokers simply don't have the information they need to be able to provide accurate quotes."

Many farm suppliers remain unable to fix their energy costs, and it is difficult to secure long-term contracts. The situation is particularly challenging for suppliers reliant on liquefied gas and heating oil.

Currency fluctuations and the fallout from the government's mini Budget aren't helping either, says Mr Barker. "Animal feed and crop protection products are priced in dollars and there has been considerable movement in the value of sterling."

Suppliers are keen to understand farmers' intentions sooner rather than later when it comes to securing farm inputs. "Communication is key and that works both ways up and down the supply chain," says Mr Barker.

This should include avoiding the temptation to order inputs at the last minute. Although gas prices are coming down, domestic and imported fertiliser supplies and prices remain uncertain.

JEFF HOLMES

TRANSITION FARMER ANDREW MCFADZEAN

Transition farmer Andrew McFadzean has reduced his reliance on bought-in energy to help secure a sustainable future for his business. Two biomass boilers supply energy to 195ha Dalchomie Farm, near Maybole, Ayreshire. They also generate an important income from Renewable Heat Incentive payments.

A 200kW biomass boiler supplies hot water to a high-pressure washer and heats the office and houses. A 350kW unit heats a wooden grain-drying floor, helping to offset the cost of 20-30 annual drying days. The units are fed by 600t of wood annually, bought in 12ft lengths, then dried and chipped on-farm. Some woodchip is sold to local farmers, creating another revenue stream alongside the beef and arable enterprises.

Mr McFadzean says the venture has helped to cushion the farm from rapidly increasing energy prices. Its success has prompted a plan for solar energy under a 25-year investment scheme. Two 200kW units totalling 500 solar panels will be installed on the roofs of two new buildings. Batteries storing 30kW will send power to the grid at the highest price point.

● **Follow Andrew McFadzean and our other Transition Farmers as they adapt their business for the new environmental schemes and the phase-out of the Basic Payment Scheme. Find out more on p5**

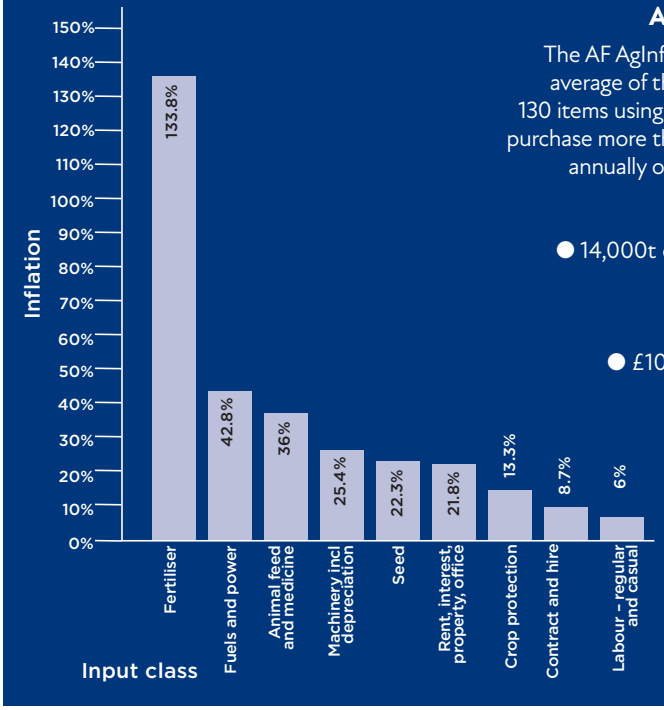
AGINFLATION INDEX

The AF AgInflation Index is a weighted average of the real costs of more than 130 items using data from AF buyers who purchase more than £250m of farm inputs annually on behalf of 3,000 farmers.

Each year, AF purchases:

- 200,000t of fertiliser
- 14,000t of cereal and pulse seeds
- 105,000t of feed
- 90m litres of fuel
- £2m of tyres
- £10m+ of building materials.

Source: AF Group



LLOYDS BANK

Download the full factsheets by visiting lloydsbank.com/sustainable-agriculture

Supporting farmers transition to Net Zero

Why focusing on Net Zero is important?

Climate change is one of the biggest challenges facing the UK today. The UK Government has set an ambition to be Net Zero by 2050, and many businesses and supply chains within the agriculture sector have committed to an even more ambitious goal of transitioning to Net Zero by 2040.

What does Net Zero mean?

Net Zero refers to achieving an overall balance between the emissions produced and emissions taken out of the atmosphere. This is in contrast to a Gross Zero target, which would reduce emissions from all sources to zero. A Net Zero emissions target is more realistic because it allows for some residual emissions. While agriculture is a significant contributor of greenhouse gas emissions, its management of land means that it is also uniquely placed to sequester carbon from the atmosphere through solutions such as tree planting, improving soil health and use of renewable energy.

What options can the arable and livestock sector take to reduce emissions?

Dairy: key emission challenges are reducing methane from digestion. This is produced as fibre is broken down by bacteria in the rumen.

Steps to focus on:

1. Target improvement in feed efficiency by producing higher quality, homegrown feeds and increasing levels of carbohydrates in the diet.
2. Optimising replacement numbers by maximising the genetic potential within the herd can achieve emission reduction through enhanced health traits, increased longevity, lower nitrogen excretion rates, and improving fertility.

Arable: key emission challenges are reducing impacts from nitrous oxide which are generated from the cultivation of soils and the production and application of mineral nitrogen.

Steps to focus on:

1. Maintain ground cover using cover / catch crops in arable rotations.
2. Adopt regenerative principles to minimise soil disturbance, maximise crop diversity, keeping the soil covered, maintaining a living root year-round and where appropriate, integrate livestock to build organic matter levels.

Livestock: the key challenge for beef and sheep farms is to reduce methane levels by focusing on breed, feed, genetics and management of manures.

Steps to focus on:

1. Improving feed quality and selecting types of homegrown forage to optimise rumen performance and lower protein requirements.
2. Adapting grazing strategies to rotational, high density grazing for short durations with longer grass recovery (i.e. mob grazing).

Poultry: the key challenges are addressing feed production, use and management which are responsible for 78% of total emissions within broiler units and 69% within layer production farms. These emissions are largely due to land use change associated with sourcing certain proteins, particularly soya.

Steps to focus on:

1. Reducing crude protein levels relevant to growth rate and age of the bird is an essential step.
2. Identifying alternative methods of treatment for poultry litter such as applying additives or alum can reduce ammonia emissions by 20-30%.

Pigs: feed and feed production are the main challenges and contribute up to 80% of emissions from pork. Improving feed conversion efficiency, reducing direct emissions from slurry and manure management, and lowering energy requirement in equipment are all important focus areas.

Steps to focus on:

1. Sourcing alternative feeds and reducing reliance on soyabean meal which is connected to deforestation is a critical action.
2. Genetic planning can support reducing feed requirements as well as targeting improved growth rates.

Evans family: Huw Alun, Rhianwen and Rhys farm at Hengwrt near Dolgellau in North West Wales

To find out more
Call 01970 625050
Email info@hybucig.cymru
Visit www.meatpromotion.wales

Pioneering scheme researches biodiversity of Gwynedd farm

Huw Alun Evans is taking part in a pioneering research project to see how his stock can support increased biodiversity while continuing to produce Welsh Beef and Welsh Lamb.

The environmental auditing programme, launched during the summer, will evaluate where Welsh upland farming stands in terms of its environmental credentials, and what scope there is for further improvement.

Huw and son Rhys are part of Hybu Cig Cymru – Meat Promotion Wales' Hill Ram Scheme and the family jumped at the chance to participate in the biodiversity audit because "you can't manage what you don't measure" is Rhys' mantra.

Huw, with wife Rhianwen and two of their three sons (third son Llŷr is a teacher), Huw Ynyr and Rhys, farm 300 acres at Hengwrt in Rhydymain near Dolgellau.

The farm extends from 400 to 2400 feet to the summit of Rhobell Fawr mountain on the western end of the Arenig range.

Lambing their flock of Welsh mountain Meirionnydd type ewes outdoors on the inbye, they are moved uphill to the mountain after lambing. Winter grazing is sought for 100 replacement ewe lambs on the Welsh-English lowland borders and lambing begins at Hengwrt in April.

Rhys said: "If you have a thriving biodiversity and environment on the farm then the condition of your natural resources is strong and that is what gives you the bedrock to then produce food.

"We're fairly confident that our biodiversity is good at Hengwrt, but we need it measured so we can sustain it, and further improve it."

"We try to farm within the natural abilities of the land, using native breeds and not overstocking. We believe it's important to work within the natural production capacity of the farm, without compromising wildlife and the environment."

Hengwrt lambs are sold deadweight with some breeding stock sold off the farm and draught ewes sold for further breeding at three and four-years-old at their local market every autumn.

Since 2018, Hill Ram Scheme farmers have been using DNA-based technologies to record the performance of hill flocks, enabling farmers to use genetic data to breed selectively to improve farms' commercial performance and sustainability.

Father Huw Alun Evans explains: "The Scheme has given us the tools and expertise to use the data we collect to identify poorer performing ewes, this has enabled us to improve the flock performance in general.

"Our pedigree herd of Welsh Black cattle are descendants of my grandfather's stock, bought when he purchased Hengwrt in 1927. We are very proud of the cattle's family bloodline."

It's estimated that just under 10% of the farm at Hengwrt is woodland, with nearer 20% tree covering on the inbye land only, a haven of shelter for stock during winter and summer.

Trickling brooks and small ponds dot the farm plus corridors of hedges planted as part of the Snowdonia National Park scheme.

The variety of plants and flora is varied within the hay meadows, grassland and mountainous areas of the farm. Heather, wild orchids, sundews, sedges and wild thyme attract bees, insects, birds and small mammals.

John Richards, HCC's Producer and Processor Lead, commented "The family at Hengwrt are a great example of how a productive farming system can incorporate measures which enhance the natural environment and overall sustainability. Being able to improve commercial productivity and environmental outputs simultaneously will be crucial for the Welsh farming sector over the coming months and years."

Rhys concludes: "We're really looking forward to seeing the biodiversity report. I think there's a huge opportunity for us as an industry to showcase to the world what sustainable farming looks like. We're up to the challenge to be part of the solution not the problem."

HCC's Hill Ram Scheme is one of three 5-year projects in the Red Meat Development Programme by the Welsh Government Rural Communities – Rural Development Programme 2014-2020, funded by the European Agricultural Fund for Rural Development and the Welsh Government.

Jargon buster

The quest to reduce emissions and reach net zero can be confusing. To make it easier, *Farmers Weekly* teamed up with the AHDB and Trinity AgTech to provide some plain English definitions

CHRIS LOFTY/ADOBE STOCK

Additionality

Reductions by a genuine carbon offset (see definition below) must be "additional" to what would have been achieved had the project not been carried out. *(FW)*

Afforestation

When new trees are planted or seeds are sown in an area where there were no trees before, creating an entirely new forest. *(AHDB)*

Agroforestry

Land use management system in which trees or shrubs are grown among crops or pastureland. *(TA)*

Ammonia

Ammonia is not classified as a greenhouse gas. But it can have a damaging impact on biodiversity and disrupt sensitive habitats and ecosystem resilience. It also harmful to human and animal health. *(AHDB)*

Baselining

Every project needs to determine what its emissions would have been if the project was not implemented (its baseline emissions). The number of credits a project receives is calculated by subtracting the project emissions from the baseline emissions. *(TA)*

Biodiversity

Variety of plant and animal life found on Earth or within a particular habitat. *(TA)*

Carbon

A chemical element. Solid at room temperature, carbon atoms are extremely abundant and stored in soils, plants and fossil fuels. It is often incorrectly and confusingly used as shorthand for carbon dioxide. *(AHDB)*

Carbon credit

Permit that allows the owner to emit a certain amount of carbon dioxide or other greenhouse gas. Usually one credit allows emissions of 1t of carbon dioxide equivalent. *(AHDB)*

Carbon dioxide

Gaseous molecule made up of one carbon atom and two oxygen atoms. It is mainly emitted by respiration and combustion, and as the benchmark global warming agent is assigned a potential of 1. It persists in the atmosphere for 300-1,000 years according to Nasa. *(AHDB)*

Carbon dioxide equivalent (CO2e)

Yardstick measurement with a global warming potential of 1. Other gases have their potential expressed as the equivalent amount of carbon dioxide, usually expressed in million tonnes of carbon dioxide equivalents. Methane, for example, has a CO2e 28 times that of carbon dioxide. This means every 1m tonnes of methane released will be equivalent to emissions of 28m tonnes of carbon dioxide. *(AHDB)*

Carbon v carbon dioxide

Plants and soil store carbon, but carbon dioxide in the atmosphere contributes to climate change. One tonne of carbon is equal to 3.67t of carbon dioxide so 10t of carbon stored is equivalent to 36.7t of carbon dioxide emissions. *(AHDB)*

Carbon finance

Money made available by a private firm or government to another business in exchange for storing or sequestering carbon. *(AHDB)*

Carbon flux

When carbon moves between two systems, such as plant material and the atmosphere. *(AHDB)*

Carbon footprint

The impact of a production process on climate change is calculated and expressed as its carbon footprint. *(AHDB)*

Carbon insets/ insetting

Offsetting emissions through a carbon project within the same supply chain. In contrast, carbon offsetting is when an organisation buys carbon credits to offset its emissions externally. *(TA)*

Carbon intensity

Every product or action has a different carbon "cost". The amount of carbon emitted per action is its carbon intensity – for example, the amount of carbon dioxide created for every kilogram of fresh produce. *(TA)*

Carbon neutral

When the amount of carbon being removed from the atmosphere by a process or action is exactly equal to the carbon emitted. *(TA)*

Carbon offsets/offsetting

Reduction or removal of carbon dioxide emissions, or other greenhouse gases, to compensate for emissions made elsewhere. Offsets are measured in tonnes of carbon dioxide equivalent (CO2e). When one company removes a unit of carbon dioxide from the atmosphere, it can generate a carbon offset, which can be bought by another company to reduce its footprint. *(TA)*

Carbon reduction

Cutting the amount of emissions that would happen under business-as-usual circumstances. *(TA)*

Carbon removal

Drawing carbon dioxide out of the atmosphere and storing it in natural reserves such as soil or plants. Also known as "sequestration". *(TA)*

Carbon retention

Act of retaining carbon in trees or soil once it has been removed or "sequestered". *(TA)*

Carbon reversal

Release of carbon stored in trees or soil back into the atmosphere, whether intentionally or unintentionally. *(TA)*

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Carbon sink

If the carbon sequestered exceeds the amount emitted, the store of carbon is increasing and is known as a carbon sink. *(AHDB)*

Carbon stocks

Amount of carbon held in an ecosystem. For example, soils where quantities vary enormously, ranging from sandy arable soils with less than 40t/ha of carbon to peat soils with up to 300t/ha. *(AHDB)*

Carbon trading

Process of buying and selling carbon permits and carbon credits that allows the permit holder to emit carbon dioxide. Companies can pay another firm to sequester carbon instead of reducing their own emissions. *(AHDB)*

Climate change

Process by which the climate alters over periods of many years. *(AHDB)*

Co-benefits

Additional environmental, social, health, or economic benefits that accompany a carbon project. These additional benefits often support the United Nation's sustainable development goals and can help bolster the value of a carbon credit. *(TA)*

Deforestation

Deliberate clearance of forested land to make way for agriculture or development. *(AHDB)*

Denitrification

Microbial process of changing nitrates into gaseous forms of nitrogen, such as nitrous oxide and nitrogen. It is one of three ways nitrogen is lost from the soil. The other ways are volatilisation and leaching. *(AHDB)*

Feedback loop

Spiral that accelerates (positive) or decelerates (negative) a trend. Clouds, for example, hold heat radiated from land. As air warms, water evaporates – creating more vapour in the atmosphere. The extra vapour holds in more heat and the process accelerates. *(AHDB)*

Global warming potential (GWP)

Measurement of how much impact a gas has on atmospheric warming compared to carbon dioxide. Each greenhouse gas has a different atmospheric warming impact, and some remain in the atmosphere longer than others. The most common metric to measure greenhouse gas emissions is GWP100 – global warming potential measured over 100 years.

GWP*

Means of measuring carbon in the atmosphere, taking into consideration the effect of short-lived gases (such as methane). *(TA)*

Greenhouse gas (GHG)

Gases that trap heat when released into the atmosphere, causing global warming and climate change. *(TA)*

Greenwash

A form of advertising or marketing to make people believe an organisation is more environmentally friendly than it is. *(TA)*

IPCC Guidelines

The Intergovernmental Panel on Climate Change (IPCC) is the UN's body for assessing the science related to climate change. It provides a technically sound, methodological basis of national greenhouse gas inventories, prepared by the Task Force on National Greenhouse Gas Inventories. The latest refinement took place in May 2019 during the IPCC's 49th Session in Kyoto, Japan. *(TA)*

International Standards Organisation

ISO is a worldwide network of experts who develop internationally agreed standards for products, processes, services and materials. *(TA)*

ISO 14064 accreditation

Principles and requirements providing guidance at project level for the quantification, monitoring and reporting of activities intended to cause greenhouse gas emissions reductions or removal enhancements. *(TA)*

ISO 14065 accreditation

Principles and requirements for bodies that carry out validation or verification of greenhouse gas claims. *(TA)*

Methane

One of the two main greenhouse gases emitted by agriculture. It has 28 times the impact of carbon dioxide but persists for much less time in the atmosphere. Methane is largely a product of livestock production, mostly from enteric fermentation in ruminants but also from slurry, manure and waterlogged land. See "nitrous oxide". *(AHDB)*

Mitigation

Process of finding ways to reduce greenhouse gas emissions caused by human activity. *(AHDB)*

Natural capital

Stock of natural resources or assets on the Earth – among them geology, soil, air, water and living organisms, including trees. *(AHDB)*

Net carbon balance

Difference between the total greenhouse gas emissions and the total carbon dioxide sequestration caused by an individual, event, organisation, service, place or product. Expressed as carbon dioxide equivalent. *(TA)*

Net zero

Target of completely negating the amount of greenhouse gases produced by human activity. Net zero is achieved by reducing emissions and implementing methods of absorbing carbon dioxide from the atmosphere. *(AHDB)*

Nitrate

Compound made up of nitrogen and three oxygen molecules. Nitrates are a major nutrient for plant growth, but too many nitrates in water can lead to ecological imbalances. *(AHDB)*

Nitrous oxide

Second of the two main greenhouse gases emitted by agriculture. More potent than methane, nitrous oxide has 298 times the global warming potential of carbon dioxide. It persists in the atmosphere for more than 120 years – 10 times longer than methane. Emissions occur mainly from cropped land because nitrous oxide is mostly created by fertiliser production and its breakdown in the soil, together with the decay of other organic matter. *(AHDB)*

Reduction/removal/retention credits

Carbon credits associated to carbon reduction/removal/retention. *(TA)*

Reforestation

Process of planting trees in an existing forest where the number has been decreasing. *(AHDB)*

Renewable energy

Often shortened to renewables, the term refers to energy generated from naturally replenished resources such as sunlight, wind, water and biomass. *(AHDB)*

Scope 3 emissions

Emissions not produced by the farm itself, and not the result of activities from assets it owns or controls, rather by those it's indirectly responsible for within the supply chain. An example of this is employee travel or when we buy, use and dispose of products from suppliers. *(TA)*

Soil carbon

Carbon stored in soil's organic matter. It comes from decomposing plant material and is vital for soil health. About 58% of soil organic matter is carbon, also known as soil carbon. *(AHDB)*

Sequestration

Process by which carbon dioxide is removed from the atmosphere and stored in solid or liquid form. *(AHDB)*

Volatilisation

The loss of applied nitrogen through the conversion of ammonium into ammonia gas, which is released to the atmosphere. Losses occur from surface application of fertiliser containing urea. In addition to leaching and denitrification, volatilisation is one of the three main nitrogen loss mechanisms. *(AHDB)*

Water leaching

Movement of contaminants, including pesticides and fertilisers, carried by water into the soil, where it can take a long time to break down. *(TA)*

Water vapour

Arguably the most important greenhouse gas of all, water vapour is responsible for about half of Earth's greenhouse effect. As global temperatures rise, evaporation increases from oceans and lakes to create water vapour, which then absorbs heat radiated from the earth and prevents it from escaping out to space. This creates a positive feedback loop, further warming the atmosphere in even more water vapour in the air. *(AHDB)* ■

Is there money to be made from carbon farming?

Carbon farming was the subject of a recent webinar looking at the opportunities and obstacles for farmers wanting to take advantage of the marketplace

Carbon farming presents the possibility of new revenue streams, but there are also risks to consider.

A panel of industry experts discussed the options for making money from carbon, what the markets are like, and what's needed to get started. Here are four things to consider.

1 What are the options for making money from carbon?

There are fundamentally three routes to think about, explained Emily Norton, head of rural research, energy and projects at Savills.

"The first is that it becomes a cost of doing business, so when selling any product from the farm, you have to have a net-zero statement. Second, it becomes a marketing advantage – a point of difference in a competitive marketplace. And third is selling carbon offsets – either through sequestration or through avoided emissions."

2 Where should farmers start?

Establish a carbon baseline of the business today, advised Rory Geldard, commercial manager of NRM at Cawood. This will allow the business to maximise any opportunities available.

"Conduct a farm carbon audit to understand your carbon output, then you can understand how much carbon is being captured or sequestered – which can be easily done with soil testing."

3 What are the markets like in the UK?

The forestry sector is further ahead than farming in this area, thanks to the Woodland Carbon Code. "The code was set up in 2011, so it has already tackled a lot of the issues the other sectors are working through at the moment," said David McCulloch, head of CarbonStore at Tilhill.

The sales process is further along, too. "The Woodland Carbon Code is backed by the UK government, set up by Defra and operated by Scottish Forestry – so it comes with strong credentials," he said.

Carbon credits allow farmers and landowners as much flexibility as possible – what to sell, who to sell to and how to sell.

However, there is still confusion about how the agricultural industry will be regulated. "Carbon isn't legally defined as a property right – there are still some grey areas around how trading carbon units is going to be treated," said Ms Norton.

"We urgently need some clarification on this to give everybody certainty that this is something we need to do," she added.

Even so, some farmers have already sold carbon credits for £100 each, and there are minimum standards on the way, explained Juan Palomares, managing director at Trinity Natural Capital Markets.

"We are working on an industry initiative with several peers to come up with minimum standards for a UK carbon code by 2023," he said.

4 Is there a difference between carbon sequestered and emissions avoidance?

Emissions avoidance applies in a context where peatland is being managed badly and it's emitting carbon, explained Ms Norton. "The activities that could be implemented in those habitats would be emissions avoidance in the short term, and potentially sequestration in the long term.

Although paying farmers to destock their ruminants to avoid emissions feels incompatible with food production, making money from carbon can sit nicely alongside profitable farming.

"For people who want to use carbon as a source of income – particularly carbon sequestration – it goes hand in hand with so many good practices," said Mr Geldard.

"It is driving more sustainable approaches to land management and farmers can benefit from both an agronomic and an economic point of view." ■

WATCH THE WEBINAR

You can hear from the experts in full at **fwi.co.uk/transition-webinar-carbon**. The Transition webinars are part of the *Farmers Weekly* Transition project, which – through articles, panel discussions, podcasts and the on-farm results obtained by a group of Transition Farmers – aims to equip farmers with the information they need to adapt to some of the biggest changes the sector has seen for more than 50 years, including the loss of Basic Payment Scheme. Find out more at **fwi.co.uk/transition**

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