SPOTLIGHT
Savills Research

Soil

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Soil health • Monetising soil carbon • Returns from regenerative agriculture

50%
of the UK's soil carbon is stored in Scottish soils

£1.8bn
annual cost of soil degradation in England and Wales

40-60%
less soil organic carbon in UK arable soils because of intensive agriculture

Soil health matters

"We owe our life on earth to six inches of soil and the fact that it rains" - *Paul Harvey**

Soil is the foundation of every farm business. It is a complex mix of organic remains, minerals, bacteria, fungi, gases and liquids. As well as forming a reservoir of nutrients and water for the sustenance of life, soils also play a critical role in major atmospheric cycles of life elements, including carbon and nitrogen.

In this Spotlight, we provide an overview of emerging national policy on soil health across the UK, analyse soil carbon schemes and assess how they might help improve soil health, and crunch the numbers on a conventional versus regenerative farm management approach.

SOIL HEALTH POLICY: AN OMISSION

The degradation of topsoils through erosion, compaction, sealing and loss of organic matter represents an enormous threat to human existence. Government estimates that over a quarter of the soil (four million hectares) in England and Wales is at risk of compaction and another 13% (two million hectares) is at risk of erosion. In terms of the opportunity, Scottish soils alone store over 50% of the UK's soil carbon and across the UK soils are expected to play a significant role in mitigating greenhouse gas emissions. In part this will be due to wider adoption of minimum or no tillage, which avoids the negative effects of cultivation on soil structure. The lack of a common framework for assessing soil health and its associated climate risks has been flagged as a major concern by the Climate Change Committee. Policy to monitor, protect and enhance soils in the UK is both urgent and important.

Between 1973 and 2018, agricultural and environmental policy was set by the European Union. Various attempts were made to establish a comprehensive framework for soils, but these were blocked by national governments who considered soil to be a territorial matter, unlike air and water, which are more obviously public goods. There is a vast range of regulation dealing with soil in various policy contexts, such as planning and waste, but no comprehensive framework for its protection. Most current regulation is derived from EU water or waste legislation; this is likely to be reviewed as part of post-Brexit regulatory reform, but the renewed focus on the strategic importance of soil health means the regulatory baseline and reporting burden is likely to get much tougher.

SOIL HEALTH CONSEQUENCES

Soil is a living catalyst for production and one that is featuring more prominently in farmers' decision-making, as improved soil health increases the efficacy of inputs, reduces input need and makes soil more resilient to extreme weather events. Here are three ways that a more holistic soil health focused approach has increased the profitability of farming:

1 **Arable** Blackgrass is a serious problem on many farms – across the UK herbicide-resistant blackgrass is estimated to reduce wheat yields by 5% and gross profit by £490 million per year. It thrives in cold, wet, anaerobic soil, so improving soil structure can reduce its competitiveness. The weed also prefers bacteria-dominated soils, so reducing cultivations can allow beneficial networks of fungal hyphae to address the balance.

2 **Livestock** Dung beetles perform about £473 million worth of work each year helping fertilise land and aerate soil, but their populations can be reduced by anthelmintic wormers. Adopting rotational mob grazing can reduce the need for wormers, while boosting the rate of livestock growth and soil organic matter formation.

3 **Cover crops** An AHDB study in 2020 found cover crops reduce margin in 95% of cases due to seed and establishment costs. Since then, the situation has improved as cover crops can unlock additional Sustainable Farming Incentive (SFI) income and carbon payments. However, while the short-term bottom line is important, cover cropping can significantly increase soil organic matter, leading to improved soil quality and mineralisable nitrogen supply.

UK SOIL HEALTH POLICY OPPORTUNITY

As UK agriculture and environment policy is devolved, each home nation is now developing its own approach to tackling the critical topic of soil health. Defra has been criticised this year for weakening its 2009 vision for all soils to be managed sustainably by 2030. The new target in the Environmental Improvement Plan 2023 may be lower, but it is more specific and enforceable. *Figure 1* sets out the different approaches being taken across the country.

ASSESSING SOIL HEALTH ON FARMS

Farmers interested in understanding their soil health have access to practical tools such as the AHDB's Soil Health Scorecard (*see figure 2*).

WHAT IS SOIL HEALTH?

The health of soil can be described as its ability to meet a range of ecosystem functions as appropriate to its environment. This could be the ability to sustain plant and animal productivity (agronomic health), to sustain biodiversity (ecological health) or its function in sustaining atmospheric cycles (environmental health). Soil health indicators are physical, chemical and biological properties of soil that can be measured and evaluated to assess soil health. With no framework for consistent data collection, UK-wide trends in soil health are not available.

LEADING THE WAY

Northern Ireland has commissioned a comprehensive soil baseline for the country. Covering an estimated 700,000 fields, farmers participating in the Soil Nutrient Health Scheme will get a detailed soil nutrient status, runoff risk maps, estimates of carbon stored in soils and biomass, and training on the use and application of the information. Due to the scale of the task, this is being rolled out regionally, with full coverage expected by 2026.

> **The degradation of topsoils through pressures such as erosion, compaction, sealing and loss of organic matter represents an enormous threat to human existence**

UK soil health policy

Territory	Scotland	England	Wales
Land cover in agricultural usage (%)	80%	69%	90%
Legislative framework	Soil Framework (SF) 2009 Agriculture Bill expected 2023	Agriculture Act 2020 Environment Act 2021	Wellbeing of Future Generations Act (Wales) 2015 Environment Act (Wales) 2016 Agriculture Bill (Wales) 2022
Targets	SF overall goal: "Promote the sustainable management and protection of soils consistent with the economic, social and environmental needs of Scotland".	Environmental Improvement Plan 2023: At least 40% of England's agricultural soil will be in sustainable management through new farming schemes by 2028, increasing to 60% by 2030.	Future Generations target for a resilient Wales: "A nation with healthy functioning ecosystems that support social, economic and ecological resilience and the capacity to adapt to change (for example, climate change)".
Indicators	13 soil health outcomes identified in SF 2009, no 'universal' soil health indicator.	By 2028, government to: 1. provide a methodology and tools to collect consistent information about the health of the soil under all land uses. 2. Establish a soil health indicator under the 25 Year Environment Plan Outcome Indicator Framework.	Future Generations National Indicator 13: Concentration of carbon and organic matter in soil (currently stable).
Schemes	Preparing for Sustainable Farming (2021) - payments for soil carbon audits available until 2024. Vision for Agriculture (2022): soil health practices such as cover crops and reduced inputs may be conditional or elective.	Sustainable Farming Incentive – Arable and Horticultural Soils Standard (2022): payments for soil management plans, soil testing and over winter cover crops.	Sustainable Farming Scheme (SFS) 2025: Nutrient accounting and soil testing, including biological and physical features, will be a Universal Action.
Baselines and land use standards	Strong industry support for baseline on soil health. The role that whole farm plans may play in farmers accessing rural funding is still to be determined.	By 2028, farmers "to be supported to establish their own soil health baseline". Future land use standards to be established by 2024.	National Minimum Standards to be included in SFS. Synthesis of Welsh soil evidence published in 2022.

figure 1

Source Savills Research

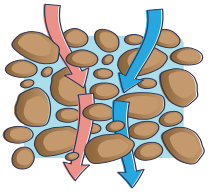
AHDB Soil Health Scorecard

These indicators are applicable to England and Wales

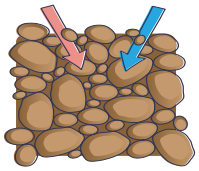
Soil structure – using visual evaluation	Suggests rooting capacity and water retention. Assessed on a standardised scale
Soil pH	Soil acidity level affects a plants ability to absorb nutrients. Assessed using simple in-field or lab test
Extractable nutrients (phosphorus, potassium and magnesium)	These are essential for plant growth and development. Well-established lab testing protocols used
Earthworms	Quantity and diversity indicates healthy soil. Simple visual assessment of presence and activity is made
Soil organic matter	Indicator of multiple soil health attributes. Well established lab testing protocols available

figure 2

Source Savills Research



Score 1 - Crumbly



No moisture and no air

Score 5 – Very compact

WHAT IS VESS?

Visual Evaluation of Soil Structure (VESS) is a protocol for assessing and scoring soil health in the field. The physical structure of soil is critical for allowing aeration, drainage and the supply of water and nutrients to growing plants. To undertake a VESS, farmers should visually assess the soil surface to target problem areas, then dig a soil pit to spade depth. Examine any visible layers in the soil and score the worse one based on how it breaks apart, from crumbly (1) to very compact (5). Adjust field management accordingly.

> “There are now viable options available to arable farmers that will allow them to earn income from carbon certificates”

Carbon management hierarchy for all businesses

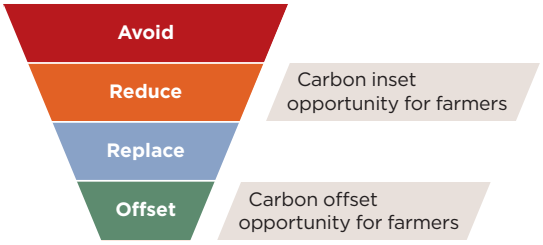


figure 4 **Source** Savills Research

Carbon insets and offsets compared

Inset	Offset
“Investing in carbon projects related to a company’s own supply chain”	*“Investing in carbon projects not related to a company’s own supply chain”*
Farmer	
Transformational, it can support the adoption of regenerative agriculture	Transactional and may impede the farm’s own ability to reach net zero
Potential buyers limited to those in the food supply chain	Large pool of potential high-value buyers
Lowers the farm’s carbon emissions	Does not count as lowering the farm’s carbon emissions
Upstream customer	**Offset purchaser**
Develops sustainable supply chains	Direct but outsourced emissions reduction activities
Proactive and aligns the interests of all parties in a supply chain, promotes behaviour change	Reactive credit purchase that can avoid or delay behaviour change by seller and buyer
Requires more planning and data transfer within supply chains and customers may not want to pay for or plan the investment needed	Simple transaction, businesses can readily buy offsetting credits
Global impact	
Reduces absolute global carbon emissions	Does not reduce absolute global carbon emissions

figure 5 **Source** Savills Research

Is now the right time to enter the voluntary carbon market?

We look at the maturity of soil carbon schemes in the UK and how to develop a carbon strategy that is designed to suit your business

Soil carbon schemes have frequently been described as a Wild West, but 2023 is the year that this changes: the sheriff is getting reinforcements. During the last six months international and national governance frameworks for the voluntary carbon market (VCM) have progressed significantly.

Whether the time is right to enter the VCM, and how, is a decision for each business. By evaluating the nature of its activities, its business objectives and likely supply chain expectations, baselining its current carbon emissions and calculating its potential for reduction, a business can develop a carbon strategy to steer how it progresses towards net zero and engages with the VCM.

Working through the carbon management hierarchy (*figure 4*) will help a farm business identify ways it can cut its own emissions and highlight how it can help other non-land based businesses on a similar journey.

If a farm business wishes to generate income from the sale of carbon credits, a key decision is whether to select a scheme focused on carbon insetting or offsetting. While the on farm actions to generate carbon insets and offsets can be very similar, they are different concepts; *figure 5* sets out the differences for both the farmer and carbon customers. A key distinction is that insetting also lowers the farm’s own carbon footprint, whereas offsetting does not as the benefit of the carbon credit can only be claimed by its purchaser. Selling offsets could therefore have more implications for the farm’s own path to net zero if its soil carbon sequestration is not able to be counted.

INSETTING COMMODITY CROPS

Major retailers are increasingly working directly with farmers in their supply chain to cut emissions. Currently the focus of this insetting activity is on their branded products, and the meat, dairy and vegetable categories, yet many have set ambitious net zero goals so it stands to reason they must address commodity crops such as cereals too. Relationships in commodity crop markets are more transient, sourcing is dynamic and supply lines are not segregated, so they need a different approach to tracking and insetting carbon emissions. The “supply shed” concept promoted by the Value Change Initiative is one solution here – a food processor or retailer works with a group of suppliers to cut carbon emissions by a verified amount in a defined geographic market (the

£20-£35
Current values per tonne of CO_2e for soil carbon certificates

€1m
paid out to farmers by Soil Capital across France and Belgium in 2022

£250-£500m
Green Alliance estimate of the annual value of soil carbon sequestration in the UK

"supply shed"). It can claim the benefit of those carbon reductions regardless of which farm in the "supply shed" it actually buys crops from. The approach is a pragmatic solution, however governance processes still need to be defined.

DEVELOPING A HIGH INTEGRITY MARKET

To attract the investment that is needed to reduce carbon emissions, trusted standards and robust governance are essential. To fulfil this independent governance role internationally the Integrity Council for the Voluntary Carbon Market (ICVCM) has been formed and in March 2023 it published its Core Carbon Principles (CCP) (*figure 6*), which are the basis of its assessment framework. The CCP label will be an international sign that shows a carbon credit has high integrity. Carbon credits will be able to be marketed with the CCP label if their category and programme have both been assessed by the Integrity Council and meet the criteria set out in the CCPs.

Other carbon credit ratings are also emerging. BeZero and Sylvera offer an alternative approach, where the companies provide a risk-based assessment of the likelihood that a carbon credit will deliver its promise of one tonne of CO_2e avoided or removed. Their scores communicate quality in a manner that mirrors the bond market ratings offered by Moody's and Fitch.

SOIL CARBON SCHEMES

Following a review of soil carbon schemes in the UK, we have found that there are now viable options available to arable farmers that will allow them to earn income from carbon certificates. Schemes focused on livestock farms are less established. The arable schemes are verified against the globally recognised Verra VM0042 or ISO 14064-2 standards and it is possible to focus on the insetting or offsetting market. Our analysis suggests there is limited downside risk to taking part:

1 Payments reflect the annual improvements made through emissions reductions and carbon sequestration so the potential carbon certificate income would otherwise be missed if the practices were adopted without joining a scheme.

2 They are flexible enough to reflect real farming practice. Schemes are typically 10-15 years and contracts are non-binding. If the farmer breaks it the consequence is usually financial, e.g. to forfeit income from 10-20% of the certificates awarded. There are no ongoing restrictions on the farmer's management of their land.

3 The payments are stackable with the Sustainable Farming Incentive allowing both to be claimed. While ongoing compatibility cannot be guaranteed, Defra's stated intention is to enable private finance and markets rather than impede their development. Emerging policy in Scotland and Wales is similar.

WHAT ABOUT PRICE?

Relative to the 100 year permanence commitments offered under the Woodland Carbon Code, the shorter commitments linked to soil carbon certificates could reduce their market value. However, payments can be layered with productive land use and the story of regenerative transition can be harnessed to add value. It is possible to partner with the carbon broker to share in any future value uplift if carbon certificates are resold.

Soil carbon certificate pricing will evolve as it becomes more established and global business focuses more on its requirements. Current values are £20-£35 per tonne of CO_2e after fees and sales commission. Certificates are referred to like wine as a "vintage"; the Soil Capital scheme paid farmers £26.70 per tonne of CO_2e for its 2022 vintage.

ICVCM CORE CARBON PRINCIPLES

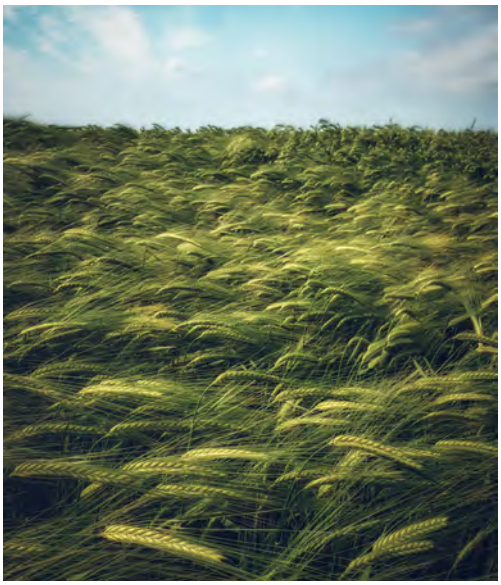
Governance
- Effective governance
- Tracking
- Transparency
- Robust independent third-party validation and verification

Emissions impact
- Additionality
- Permanence
- Robust quantification of emission reductions and removals
- No double counting

Sustainable development
- Sustainable development benefits and safeguards
- Contribution to net zero transition

figure 6

Source ICVCM



WHAT HAPPENED TO THE UK FARM SOIL CARBON CODE?

A national consortium led by the Sustainable Soils Alliance was awarded funding by the Environment Agency in July 2021 to develop a UK Farm Soil Carbon Code. During the course of the project, it became clear that the most effective way to add value to the marketplace was through the creation of "Minimum Requirements", against which schemes could be evaluated. Issues such as measurement, reporting, verification, additionality and permanence were addressed, along with soil sampling methods and managing changes in land ownership. The Minimum Requirements were developed following a comprehensive review of international agricultural soil carbon market standards, so existing UK schemes are likely to be broadly aligned. Defra's 2023 Nature Markets Framework launched a three year project with the British Standards Institution to establish official UK-wide investment standards for nature markets. Its remit is broader, but is likely to include soil carbon standards, which could be informed by the Minimum Requirements.

CAN TENANTS JOIN SOIL CARBON SCHEMES?

Contractual flexibility means current soil carbon schemes are highly accessible to tenants. In some cases they can join freely, in others either an Agricultural Holdings Act tenancy, remaining term greater than five years, or landlord's counter signature is required. As the tenant is only monetising carbon certificates generated through their agricultural husbandry; and management restrictions do not persist beyond the scheme's agreement term, they are not disposing of carbon in a way that is deleterious to their landlord's longer term interests. Indeed incentivising improved soil health is beneficial to their landlord's property.

6 years
the turning point in conventional vs regenerative profitability

2027
Carlsberg Marston's target for only using regeneratively grown malting barley

18%
increase in year six net margin in the Savills Virtual Farm regenerative system model

Is regenerative agriculture financially viable?

We look at the current thinking and the various options open to farmers

The intensive nature of modern agriculture has reduced soil health and impacted its productivity causing a reduction in the ecosystem services it provides to society. Regenerative agriculture seeks to reverse this trend, going beyond the "do no harm" principles of sustainable agriculture.

WHAT IS REGENERATIVE AGRICULTURE?

Unlike organic farming, there is no set definition of regenerative agriculture. At its core it is a collection of practices that will improve soil health, sequester carbon and have a positive impact on water and biodiversity in the local environment, while still producing food. Our Regenerative Agriculture Spotlight explored the topic in detail; its implementation is site and context specific so the emphasis placed on individual practices varies with suitability, making analysis of a generalised business case for adoption challenging. For the purposes of this report, we have considered the five core principles in the context of the Savills Virtual Farm. These are:

1. Minimise soil disturbance
2. Maximise species diversity
3. Keep the soil covered and build organic matter
4. Maintain living roots in the soil year round
5. Integrate livestock

THE BUSINESS CASE FOR REGENERATIVE AGRICULTURE

While regenerative systems have a wider beneficial environmental impact, relying on philanthropy alone will not see widespread adoption of these practices. Instead, landowners will need to understand the likely yield and profitability impacts to ensure their businesses remain viable.

In the short term a transition to a regenerative system will lead to low yields and margins. The Food, Farming and Countryside Commission 2021 report modelled the yield potential of a regenerative system and found that UK cereal yields were 27% lower than in a conventional system.

However when evaluating regenerative agriculture, net margin is more important than yield or revenue. It is likely to be lower in the short term, with research demonstrating 25% reductions (James Hutton Institute), but over the long term the improvements in the soil structure will begin to bear fruit. Examples of net margins returning to normality or even improving are common, with one study showing a 78% increase in profitability, despite a 29% decrease in yield. The farm would also be less exposed to increases in input prices such as fertiliser, which have been experienced recently. Additionally, improved soil structure means it is more resilient to severe weather conditions, such as droughts and floods, which are expected to become more common.

The consensus view is that six years is a reasonable assumption for the turning point in profitability. By this point a significant increase in soil organic carbon (SOC) is commonly observed. An increase in SOC of up to 2% has been shown to increase yields and reduce the reliance on nitrogen fertiliser.

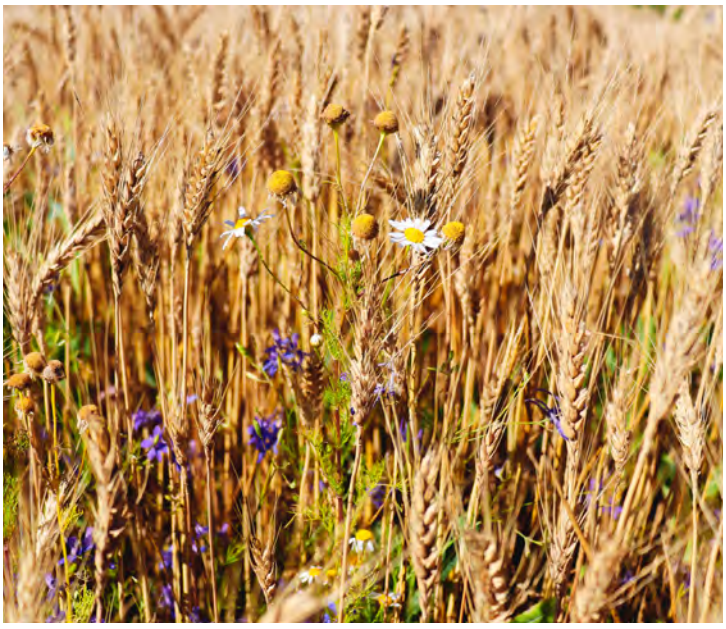
To unlock widespread adoption of regenerative practices the financial risk of transition needs to be minimised. Part of the answer could lie in carbon payments. If we assume £26.70 per tonne of CO_2e, and based on the schemes common guidelines that 1.5 tonnes per hectare of emissions reductions and/or sequestration is achievable in a regenerative system, this could result in annual payments up to £40 per hectare, or 4-5% of a typical winter wheat gross margin.

FINANCING THE TRANSITION

While regenerative agriculture is a hot topic, public funding specifically suited to these practices is currently fairly limited.

Within England, the SFI arable and horticultural soils standard offers £22-£40 per hectare for basic soil management measures, such as growing cover crops over winter and completing soil assessments. An additional payment to encourage no-tillage crop establishment is expected to be launched this year. The new SFI integrated pest management standard also lends itself to regenerative farming, with payments available for companion crops (£55 per hectare) and not using insecticides (£45 per hectare). Proposals for future Scottish and Welsh policies each reveal ambitions to be global leaders in sustainable agriculture, so suggest similar incentives will be developed for their farmers too.

As an alternative to public funding there are some opportunities to harness private finance in the push towards a more sustainable method of farming, including brands such as WildFarmed and impact funds investing in farmer training. Banks are also particularly interested in reducing the carbon footprint of agriculture, with preferential lending terms increasingly common.



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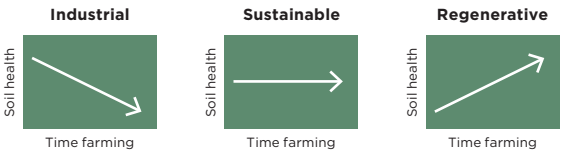
WHAT ARE THE EXPECTED BENEFITS OF REGENERATIVE FARMING?

- More resilient yields
- Improved soil health and biodiversity
- Increases in crop nutrient quality and flavour
- Lower expenditure on fertilisers
- Reduced fuel use and field traffic
- Carbon sequestration



Regenerative agriculture is about repairing and improving soil health, rather than using or sustaining current management methods

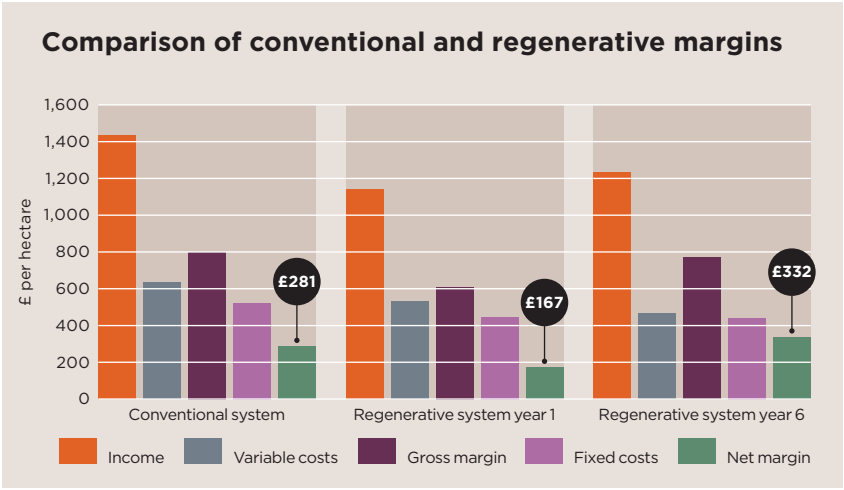


figure 7

Source Savills Research

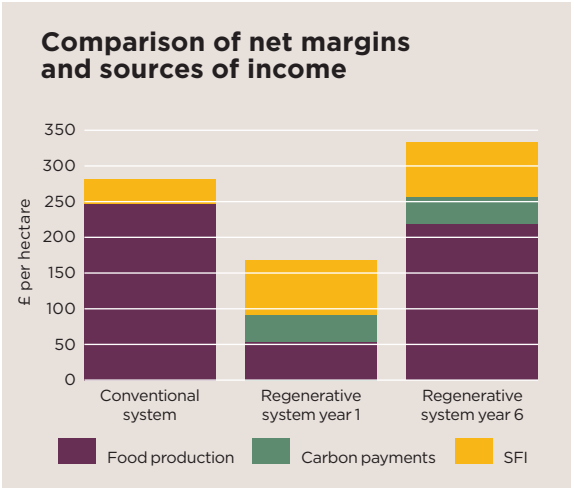


figure 8

Source Savills Research

Savills Virtual Farm

Savills Rural Research modelled the adoption of a regenerative system on its Virtual Farm, an 830 hectare top 25% arable producer on clay based soils in the East Midlands, with 810 hectares in production. We compared agricultural cropping income, SFI and carbon scheme income in a conventional system and after years one and six of regenerative farming. Basic payment scheme and delinked payment income was excluded.

While a grass ley was considered, as the farm is not located in a traditional livestock area we opted to introduce livestock for the regenerative system via a winter grazing agreement. This involves growing a crop of stubble turnips or mixed brassicas providing 12 weeks of keep for a sheep grazier who would be responsible for fencing, water and their own shepherding.

Income in the regenerative system is derived from the SFI, carbon certificates, the sale of crops and the graziers' payments. We assumed yields were reduced by 30% over the transition years in line with published research and that 1.5 carbon certificates could be generated per hectare, selling for £26.70 each. Adoption of the SFI generated a net income of £76 per hectare per annum in the regenerative system, with the majority coming from the intermediate arable soils standard and the integrated pest management standard *(figure 10)*, compared to £34 per hectare under the conventional scenario. Within integrated pest management, we took the decision to use no insecticides on two thirds of the regenerative farm, contributing a large proportion of the payment. We did not include any projected income from the standards for water body buffering and farmland biodiversity which will launch in 2024. Informed by peer reviewed studies, industry benchmarking, and experience within the Savills Food and Farming team, variable costs were reduced by an average of 16% in year one and up to 26% in year six, primarily due to reduced fertiliser, herbicide and fungicide use. Fixed costs were reduced by an average of 17% with the largest reductions applied to machinery costs, fuel and labour.

RESULTS

In year one, the net margin was 41% lower than the conventional system, despite the additional carbon and SFI income *(figure 8)*. At this stage, the SOC is depleted and the resulting reduction in yield from a fall in fertiliser usage impacts the profitability, despite lower input costs. However, when analysing the figures in year six profitability had increased to 18% above that of conventional agricultural practices. An increase in SOC and integration of cover and catch crops improves nutrient cycling and reduces the requirements for artificial fertiliser particularly phosphate and potassium. Pest burdens also reduced under the regenerative system and yields were increased by 7% in year six (still a 24% reduction from conventional yields), finally variable costs were cut by a further 10% to 26% lower than conventional agriculture.

Income from regenerative food production remained lower, even in year six, however this system benefits from reduced exposure to artificial inputs and a greater diversity of income streams. There is no one-size-fits-all approach to regenerative agriculture, and an understanding is required that significant change and the associated benefits will take time.

SVF system crops and coverage

	Regenerative	Conventional
Winter wheat	37%	40%
2nd winter wheat	0%	10%
Winter OSR	25%	30%
Spring barley	12%	10%
Spring wheat	13%	0%
Spring beans	13%	10%

figure 9

Source Savills Research

Environmental income streams compared

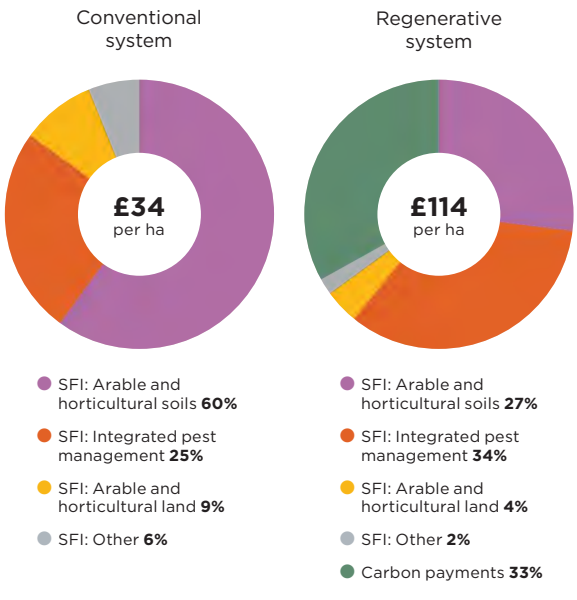
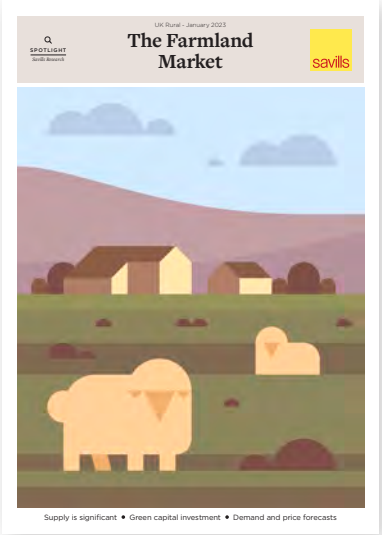


figure 10

Source Savills Research



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