UK Rural – June 2024

SPOTLIGHT
Savills Research

Food and the environment

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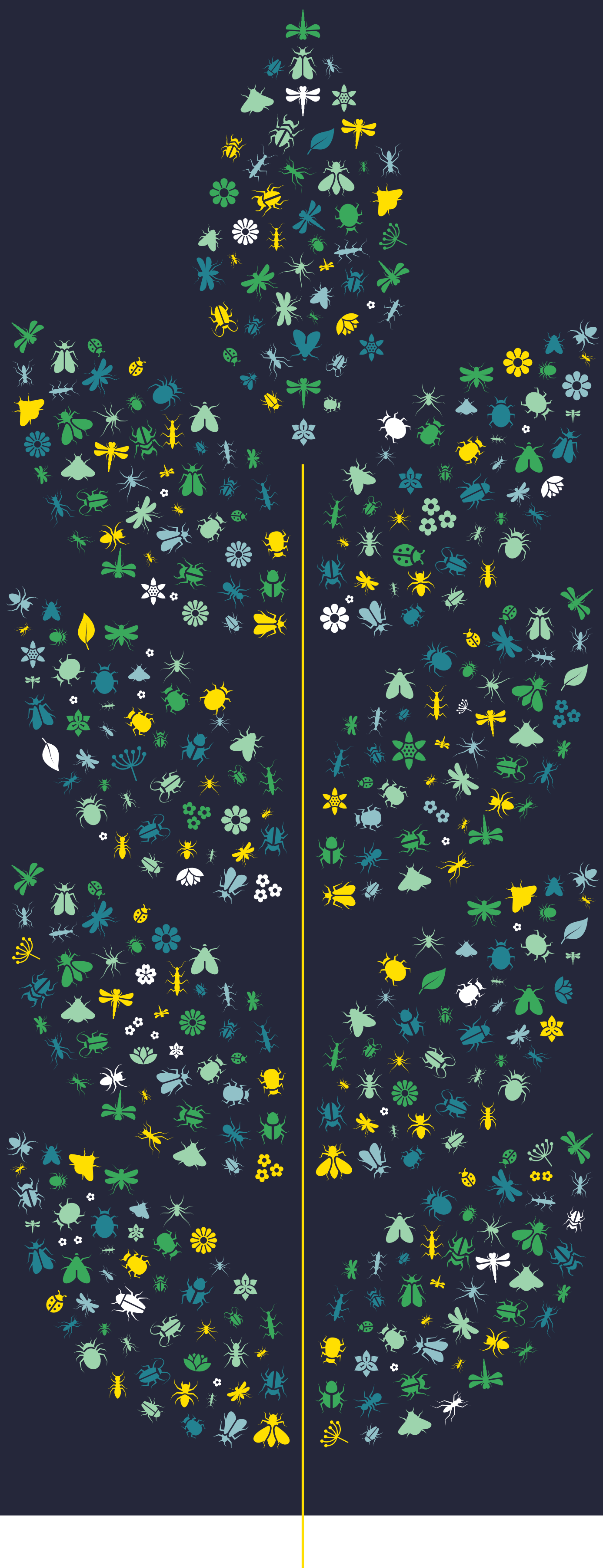
FEEDING THE FUTURE | ADOPTING NEW TECHNOLOGIES | SFI IMPROVES REGENERATIVE RETURNS



Feeding the future

Reconciling our demand for food and its impact on the environment.

70%

Proportion of the UK used for food production.

Source: Defra

80:20

80% of UK food production is on 20% of UK farms using 50% of our farmed land.

Source: Global Centre on Adaption

70%

Increase in global food production over 2005/7 levels is required to feed 9.3 billion people by 2050.

Source: Food and Agriculture Organization of the United Nations

The agricultural transition is progressing in all devolved nations and it is clear the pendulum cannot swing too hard in favour of one land use or another – a balanced and integrated approach must be found to ensure the UK can produce food and meet its environmental ambitions and targets. A recent report by the Royal Society suggests we need an additional 4.4 million hectares of land to meet these targets, an area equivalent to twice the size of Wales. Innovative thinking is needed to maximise land use to meet our requirements.

Demands from land

- Energy / renewables
- Environmental creation
- Environmental restoration
- Food production
- Forestry
- Health and wellbeing
- Housing / development
- Infrastructure
- Tourism and leisure

Is food a public or private good?

Public goods are the general direction of travel. Prime Minister Rishi Sunak recently declared food is a public good and it could be argued that Scotland and Wales have always focused on food production due to their stronger national brands. All political parties have pledged their commitment to food production with statements such as 'food security is national security' and these sentiments have since been backed up in England as Defra has capped the overall proportion of a farm that can be entered into ten Sustainable Farming Incentive (SFI) options at 25% of the farm area.

What is required from our governments?

A cross-party political approach and commitment to UK food production and security is badly needed, one that transcends short-term political cycles and allows long-term planning aligned with the commitment to environmental protection, recovery and enhancement driven by the Environment Act 2021.

However, this appears unlikely and opportunities to bring more coherence to food policy have withered. The UK negotiated post-Brexit trade deals without a clear food strategy or security policy. The National Food Strategy (2022) by Henry Dimbleby continues to gather dust and the long-awaited Land Use Framework was not published before the dissolution of parliament. The framework had also been relegated to 'guidance' so it was appearing unlikely that it would have the impact necessary to reconcile competing demands anyway.

The government did announce an annual food security index to 'monitor how we are maintaining and enhancing our current levels of food security' and complement the three-yearly UK food security report. The first release in May 2024 comprised nine indicators and reported seven to be 'broadly stable' and two to have shown 'some reduction in risks' over the past year. The future of the index is now uncertain as the requirement to publish it was not put on a statutory footing.

Scotland is ahead of the devolved nations in creating a legislative framework. The Good Food Nation (Scotland) Act 2022 aims to transform Scotland into a 'Good Food Nation' where everyone can access healthy, sustainable, and locally sourced food. Key objectives of the Act include enhancing social and economic well-being, improving public health and nutrition, supporting environmental sustainability, promoting animal welfare, and contributing to educational initiatives. Accountability is ensured through progress reports every two years.

TOP THREE TAKEAWAYS

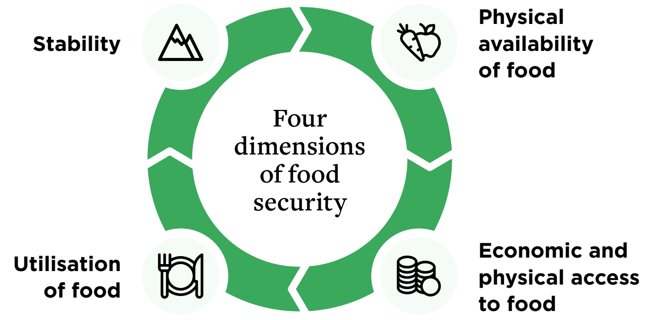
01 Land managers must develop a long-term strategy in which food production and environmental improvements co-exist. This should identify necessary behavioural, operational and financial changes.

02 Awareness of digital and biological technologies that reduce agriculture's emissions and increase competitiveness is now essential.

03 The margin for a regenerative farming system on our Virtual Farm after six years of transition is 31% higher than conventional farming.

Food secure or self-sufficient?

A definition of food security was initially agreed at the World Food Summit in 1996: "food security exists when all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food that meets their dietary needs and food preferences for an active and healthy life."



Self-sufficiency is "the ability of a region or country to produce enough food without buying or importing additional food". In its purest definition, self-sufficiency is about the volume of nutrients not the volume of a desired product. Self-sufficiency sits under the umbrella of food security, specifically 'physical availability of food'.

Food security could exist without a high level of self-sufficiency if trade was stable. Trade can provide a variety of food but is also at risk due to shocks, such as global conflicts and climate change impacts. According to the AHDB, the UK produces around 60% of domestic consumption by value. Actual consumption is around 54% as part of the UK's production is exported. There was a peak in the mid-1980s but a decline since.

A key influence on food production systems is the cost to the consumer. Food and Farming Director Adrian Matthews argues this has driven increased specialisation and intensification of production, which can lead to pressure on the environment. One example is the increase in broiler chicken production along the River Wye. Large-scale, state-of-the-art production units produce high-quality chicken at affordable prices for the consumer. However, these units are often seen as adding to environmental pressures on the river system.

Drivers of UK food production:

Geopolitics ✓	Supply chain challenges ✓
Global conflicts ✓	Inflationary pressures ✓
Population growth ✓	Economics of alternative land uses ✓
Climate change / weather patterns ✓	Economics of food production ✓
Other shocks e.g. pandemic ✓	Resource availability e.g. water ✓

Food and the environment

In the 1970s, a total focus on food production, along with a combination of technology and financial support, led to a step change in agricultural productivity and accepting a cost to the environment. In years to come though, we would be paying the price of some of those decisions. Whilst the productive land area has been relatively stable with a 3% decline over the last 20 years, climate change and ever-increasing land use demands threaten this. Although, Defra states that productivity has increased by 5% over this period.

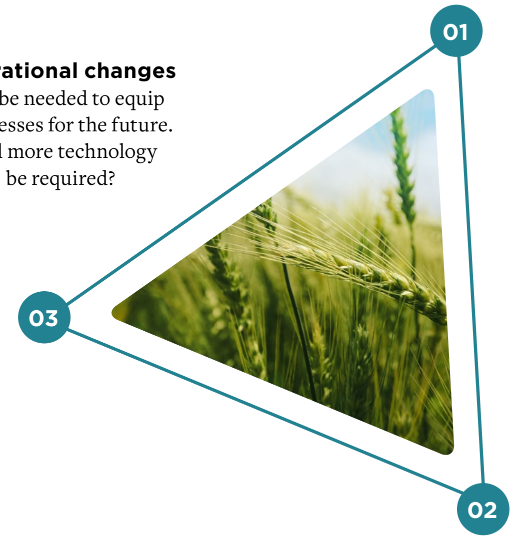
The challenge for the future is whether we need to continue to increase productivity from a decreasing land area or whether it is a more nuanced situation and we should consider our nutritional requirements and what food can be produced from our land base. Terms like sustainable intensification and regenerative agriculture are, ultimately, about finding a way of increasing farm output whilst protecting the environment. The answer could be land use management that's driven by a set of principles based on resilience.

Change is needed

It has often been felt that food production and environmental protection have been in conflict with one another, but there can be synergies - the SFI encourages these as do production systems such as Pasture for Life and Wildfarmed. Delivering strongly on both fronts is complicated but solutions must be sought. Change is inevitable and must be embraced by all, along with an evolution of skills and practices necessary to drive the innovation required to safeguard our people and planet.

Behavioural change will be required in the future to integrate food production with environmental ambitions to create sustainable practices and businesses.

Operational changes may be needed to equip businesses for the future. Will more technology be required?



Financial change will be inevitable, we have seen the start of this with the demise of the basic payment scheme. Stacked funding will be sought to ensure business profitability.

> "Food security rests ultimately not on maximising domestic production, but on making the best use of land types which vary in quality and potential uses.... There is a need to balance and integrate food production with environmental factors to support efficient and sustainable land use."

How do we increase agricultural productivity?

We look at the ag-tech in demand now, what is coming to market and the current priorities for genetic research.

6,516
Applications for productivity and slurry equipment grants in 2023.

100%
Success rate of applications for robotic silage pushers.

1.232
Kilograms of CO_2e released for each day the calving interval increases.

Innovation in agriculture is expanding rapidly in all directions, but the benefits are only realised when a technology is deployed at scale. Under the first round of the Farming Equipment and Technology Fund (FETF) 2023, applications were made for 6,516 pieces of equipment across 91 eligible items within the Productivity and Slurry theme. 26 of these items were categorised as "ag-tech" by Savills Rural Research, accounting for a quarter of all the pieces of equipment applied for (Figure 2).

Top 10 items

The variety of eligible items in the top 10 is a testament to the number of challenges agriculture faces. From direct drills to cut costs and carbon emissions, to rainwater harvesting to improve water security, the FETF provides valuable financial support to make farm businesses more sustainable and resilient (Figure 1).

Top 10 ag-tech items

Failing to spot a cow's heat extends its calving interval and leads to estimated losses of over £5 for each day conception is delayed beyond 100 days after calving. It impacts the farm's carbon footprint too – analysis by Aberystwyth University found that for each additional day, 1.232 kg of CO_2e is emitted. With known financial and environmental consequences, it is unsurprising that sensors to improve heat detection were the most applied for items overall, not just in terms of ag-tech. A lower application success rate means heat detection equipment wasn't the most common item funded, but the message is clear: proven technology will be adopted by farmers.

TOP 10 FARMING EQUIPMENT AND TECHNOLOGY FUND ITEMS

Figure 1 *Source: Savills Research, Defra*

Application rank	Item	Success rate
1	Cattle heat detection system ear tag, collar or ankle band	60%
2	Cameras for monitoring farmyard	98%
3	Cattle heat detection system base unit	56%
4	Slurry dribble bar minimum working width 6m	98%
5	Slurry dribble bar minimum working width 10m	99%
6	Variable speed drive for pumps and electric motors	99%
7	Direct drill with fertiliser placement 3m	99%
8	Heat recovery unit to heat water	99%
9	Rainwater harvesting minimum tank size 5,000 litres	99%
10	Mobile slurry chopper pump	99%

TOP 10 AG-TECH ITEMS

Figure 2 *Source: Savills Research, Defra*

Application rank	Item	Success rate
1	Cattle heat detection system ear tag, collar or ankle band	60%
3	Cattle heat detection system base unit	98%
11	Assisted steering system (retrofitted)	56%
13	Robotic slurry scraper	99%
16	Flow rate monitoring of slurry	100%
19	GPS light bar	99%
24	Robotic silage pusher	100%
25	Digital weather station	97%
27	Variable rate controller for seed drills, sprayers or fertiliser spreaders	98%
35	Calving detector	98%

Sensors

Cost: Low
Readiness: High
Ease of use: Medium

Much of the agricultural technology currently offered and adopted in mainstream agriculture is sensor-based. This will continue, with a diversification in the problems addressed by sensors from animal health, with Cowbell, to soil health, with P.E.S. Technologies' soil sensor kit.

Robotics

Cost: High
Readiness: Medium
Ease of use: Medium

Robotics is an emerging force within mainstream agriculture, with the medium readiness reflecting a range of product maturities from the well-advanced (robotic silage and slurry pushers) to developing solutions such as fruit pickers, which are not yet competitive with traditional labour solutions.

Automation

Cost: High
Readiness: Low
Ease of use: Medium

Automation is as well developed as robotics, however, the requirement to perform tasks without supervision means more is expected of automation. As such, the automation of core tasks such as spraying or drilling is still not at a deployable level.

From lab to field

The Genetic Technology (Precision Breeding) Act 2023 removed precision-bred plants and animals from the regulatory requirements applicable to other genetically modified organisms. It separated organisms whose genomes have been altered using modern biotechnology into two distinct categories:

Genetically modified organisms (GMOs): contain genes from a sexually incompatible species that could not occur through traditional breeding.

Precision-bred organisms (PBOs): include genetic changes that could have occurred naturally or through traditional breeding methods. Also commonly referred to as gene editing.

This means the regulation of PBOs is now more permissive and more in field research is being conducted. In the decade from November 2013, 30 consents were granted to release GMOs for research purposes. Since April 2022 alone, 15 notifications have been released for qualifying genetically modified higher plants (QHPs). QHPs are plants whose genetic composition is consistent with the genetic variation that could occur naturally within that species or due to traditional breeding techniques and selection, a definition almost identical to that of PBOs.

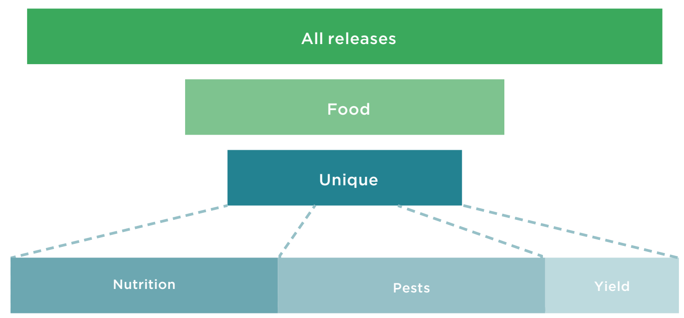
Research focus

Only 33% of the consents within the GMO notification framework are for unique, food-focused research projects (Figure 3). These consents reveal three prominent research objectives:

- **Improved yields,** such as modifying wheat to enhance its photosynthetic efficiency so more sunlight is converted into biomass.
- **Combatting pests,** such as conferring greater resistance to Phytophthora infestans, the organism responsible for the late blight of potatoes.
- **Enhancing health,** such as reducing the concentration of asparagine in wheat. At high temperatures asparagine converts into acrylamide, a carcinogenic compound.

FOCUS OF CONSENTS GRANTED TO RELEASE GMOS FOR RESEARCH PURPOSES

Figure 3 *Source: Savills Research, Defra*



OBJECTIVES OF FIELD EXPERIMENTS INVOLVING GENE EDITED PLANTS

Figure 4 *Source: Savills Research, Defra*

The shift to PBOs still sees research in these areas, focusing notably on yields and improving harvesting (two-fifths of notifications) (Figure 4). A new category also appears: environment. One example is barley edited to accumulate a higher lipid fat content in its stems and leaves. Though initially, this would seem to have a nutritional focus, the ultimate objective is to reduce methane emissions from cattle. Studies have shown that using supplementary lipids reduces the methane production of ruminants primarily through a reduction in dry matter intake. Therefore feeding this genetically edited barley to livestock would reduce methane emissions. A 2013 meta-analysis demonstrated that provided lipid supplementation did not exceed 6% of dietary concentrations, there would be no adverse effect on productivity.

Future direction

Secondary legislation is needed to implement the Act and rapid progress had been promised this year, including:

- Regulations to allow the release and marketing of PBOs.
- Policy for a science-based authorisation process for food and feed products developed using PBOs.
- Modification of plant varieties and seeds legislation to ensure precision-bred varieties can be registered on the National List following assessment by the Advisory Committee on Releases to the Environment which advises on risks to human health and the environment.

Statutory instruments ensuring animal welfare are expected to be laid between 2025 and 2026. Precision breeding in livestock could also achieve resistance to diseases such as Porcine Reproductive and Respiratory Syndrome in pigs or greater meat yields from cattle. More investigation and policy development are needed first.

> In the longer term, we can expect regenerative agriculture to become the norm.

Can farmers afford to switch to regenerative farming?

We look at arguments for change and how the economics stack up in 2024.

In simple terms, regenerative agriculture is food production that repairs and improves soil health, but what that means on the ground is complex. Defining it, or indeed whether there is a need for a definition, remains subject to debate. Our 2021 Spotlight on Regenerative Agriculture introduced the topic and the five regenerative principles. Since then, "context" has been proposed as a sixth principle but has not been universally accepted.

At the recent Future of UK Agriculture conference, delegates including farmers, buyers, researchers and applied scientists were asked whether having a universal definition of regenerative agriculture was important. Over half of the 79 respondents said yes and mostly suggested it should be broad, flexible, inclusive and easy to understand. This highlights the challenge, a universal definition is generally considered important to prevent greenwashing and support marketing claims. Still, a farm's physical and environmental conditions are not uniform so production systems are complex and adapted to specific circumstances. Hence the call for flexibility and the suggestions elsewhere that context should become a core principle of regenerative agriculture.

The uptake of these regenerative agriculture principles in the UK is on the rise, including by those who wouldn't necessarily consider themselves to be a regenerative farmer. It is being driven by farmers' growing awareness that soil is a complex and dynamic living system, not an inert substrate – and the preparation and introduction of supportive policies and financial incentives across the UK. Supply chains are a significant accelerant, compelled to reduce their environmental impact by their own net zero goals. The UK government requires sizeable private sector businesses to report their impact following the Task Force on Climate-related Financial Disclosures framework. Businesses including Arla, Carlsberg, Colmans, Honest Burgers, McCain, Nestlé, The Ethical Butcher and Waitrose are setting targets or developing projects and supply chains that follow regenerative agriculture practices.

Earning regenerative premiums

Our analysis is that early adopters, or those committed to more stringent production standards, will be rewarded with premiums for regenerative agriculture produce – and these will endure where they are tied into premium food products. More broadly the initial action in food chains has focused on short chains where food processors or supermarkets have a high degree of influence and the farm produce is a core part of the product. However, all ingredients form part of their carbon and environmental footprint, so in time the same sustainability or regenerative expectations will filter down to the commodity supply chains – such as cereals too. Which means, in the longer term, we can expect regenerative agriculture to become the norm.

Wildfarmed and The Green Farm Collective offer premiums to cereal farmers in Britain and have developed their own regenerative farming standards that growers are independently audited against. These define the production practices farmers must follow and cap or exclude the use of certain inputs.

Wildfarmed focuses on milling wheat grown with companion plants or as a bi or polycrop with pulses. The company has built a strong brand and sells its regenerative flour and products to bakeries, delis, restaurants and supermarkets.

The Green Farm Collective is also developing a premium market for milling wheat. It aims to have an impact at scale with a standard that is more restrictive than general farm practice but permits higher artificial input use than Wildfarmed. The Green Farm Collective guarantees a premium of at least £20 per tonne, over and above the usual milling premium.

Financing the transition

Last year, Savills Rural Research modelled adopting a regenerative system on its Virtual Farm – a top 25% arable producer that farms 810 hectares of clay-based soils in the East Midlands. We compared agricultural cropping income, England's SFI and carbon scheme income in a conventional system and after years one and six of regenerative farming. Basic payment scheme and de-linked payment income were excluded. Our 2023 results showed that the net margin from a regenerative farming system was 41% lower than the conventional system in year one of the transition, but by year six it exceeded the conventional system by 18% (Figure 8).

Since then, Defra has improved some SFI payment rates and crucially announced new options that support the transition to a regenerative agriculture system. These include £73 per hectare for no-till farming. Elsewhere in the UK, proposals for future agricultural schemes continue to develop, but there are no specific details. Both Scotland and Wales have ambitions to be global leaders in sustainable agriculture. Regenerative principles will be widely encouraged and supported in Wales from 2026 via universal actions in the Sustainable Farming Scheme and by Scotland's new scheme from 2027.

The Virtual Farm conventional and regenerative farming models have been updated to reflect 2024 farming economics and the new SFI options (Figure 5). Within the regenerative model, our update included 100% no-till farming and expanding longer-term environmental land uses such as grassy field corners and flower-rich margins to 5% of the farmed area. A regenerative premium is also being targeted on the 96-hectare spring milling wheat crop, so an additional £20 per tonne premium has been included and nitrogen use cut to comply with the standard's requirement.

Regenerative returns

£182 vs. £49

The net income per hectare from SFI for regenerative and conventional agriculture.

£20

Per tonne premium for The Green Farm Collective regenerative wheat growers.

31%

Higher margin for a regenerative farming system compared to conventional after six years.

Mind the gap

Switching to no-till and regenerative farming will in most cases affect yields whilst the farmers' knowledge develops and soil health improves. Informed by published research, we assumed yields were reduced by 26% at the start of the transition with some recovery to 18% below conventional levels by year six. Fixed costs were reduced by 22% in year one to reflect the adoption of no-till. Variable cost savings increase as time passes due to the integration of cover and catch crops and improved soil health. This enhances nutrient cycling and reduces artificial fertiliser requirements.

The impact in the initial years of the transition is that the net margin from food production falls 64% relative to a conventional system (Figure 6). The additional income from the SFI, carbon, and regenerative crop premiums helps to bridge the gap to some extent. It improves the overall net margin by £250 per hectare compared to £49 per hectare under conventional cropping (Figure 7).

There is still a "transition gap" in the farm's finances, but the enhancements to the SFI have reduced it significantly compared to 2023. The Virtual Farm's overall net margin in year one is now just 10% below the conventional margin, last year this deficit was 41%. Making the transition is therefore less costly, particularly if the business can support its cashflow by selling surplus machinery. Longer-term prospects have also improved, by year six the regenerative system margin now exceeds the conventional system by 31% (Figure 8). Switching to a regenerative system is a significant undertaking, and there is no one-size-fits-all approach – hence the difficulties defining it. Our model demonstrates that stacking public and private payments alongside food production can facilitate changing to a more resilient and profitable system. Long term, it's really a question of whether farmers can afford not to be farming regeneratively.

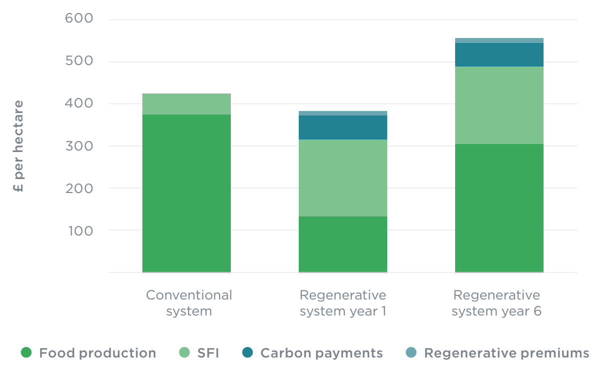
KEY SFI OPTIONS AND ASSUMPTIONS

Figure 5 — *Source: Savills Research*

		Proportion of farmed area (%)	
	£ per hectare	Conventional	Regenerative
Variable rate nutrient applications	27	100	100
No insecticide use	45	-	66
Companion crop	55	30	24
Multi-species winter cover crop	129	-	36
Grassy field corners and blocks	590	0.25	2.7
4-12m buffer strips	515	0.25	1.2
Flower rich margins and plots	798	0.5	1.2

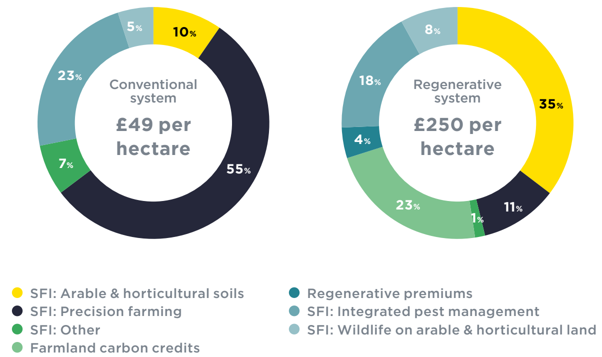
COMPARISON OF NET MARGINS AND SOURCES OF INCOME

Figure 6 — *Source: Savills Research*



ENVIRONMENTAL INCOME STREAMS COMPARED

Figure 7 — *Source: Savills Research*



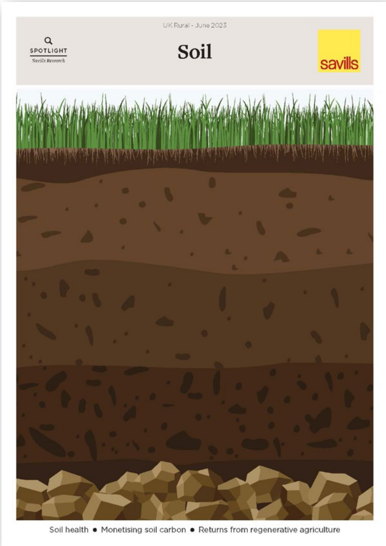
NET MARGIN* INDICES FOR THE REGENERATIVE TRANSITION

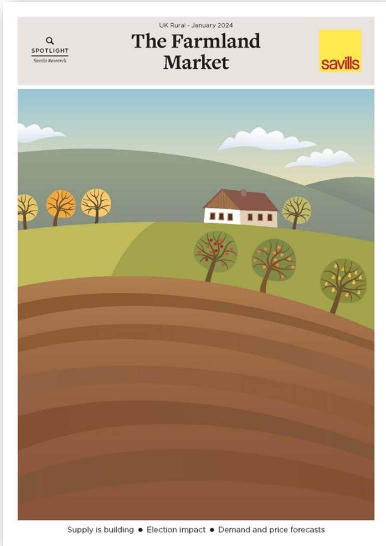
Figure 8 — *Source: Savills Research*

* Before rent and finance

FIVE OR SIX CORE PRINCIPLES OF REGENERATIVE AGRICULTURE

- Minimise soil disturbance
- Maximise species diversity
- Keep the soil covered and build its organic matter
- Maintain living roots all year round
- Integrate livestock
- Context





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