REGENERATIVE DAIRY:

MODELLING THE TRANSITION COSTS AND BENEFITS FOR FARMERS IN THE UK

CONTENTS

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WWF is one of the world's largest and most experienced independent conservation organisations, with over five million supporters and a global network active in more than 100 countries. WWF's mission is to stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature by conserving the world's biological diversity, ensuring the sustainable use of renewable natural resources, and promoting the reduction of pollution and wasteful consumption.

ABOUT THIS REPORT AND ACKNOWLEDGEMENTS

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WWF-UK. 2025. *Regenerative Dairy: Guidance for farming consultants and finance practitioners in the UK.* WWF-UK, Woking.

WWF-UK. 2025. *Regenerative Dairy: Case studies.* WWF-UK, Woking.

Farm Carbon Toolkit, 2025. *The impacts on carbon and nature associated with transitioning to regenerative dairy farming practices.*


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1. INTRODUCTION

THE ROLE OF THE DAIRY SECTOR TO SUPPORT REGENERATIVE AGRICULTURE

As the largest land user nationally, occupying 71% of the UK's total landmass, agriculture has an important role to play in restoring nature. Over generations, however, the conversion of nature-rich ecosystems to agricultural land, followed by the intensification of agriculture since the Second World War, has significantly reduced the quantity and quality of natural ecosystems. Currently the UK is one of the most nature-depleted countries in the world,[1] exposing the UK economy, especially the agriculture sector, to significant nature- and climate-related risks.[2]

The agriculture sector could lead on biodiversity and nature restoration in the UK. To improve the resilience and sustainability of farming in the UK, as well as to meet environmental targets for nature and climate, the sector needs to be supported to transition towards a nature-positive system. By transitioning to a system that integrates food production, ecosystem rehabilitation and carbon sequestration, farmers can develop systems that may be more viable and profitable, while supporting national efforts to address biodiversity loss and climate change.

The dairy sector is at the forefront of the transition to regenerative agriculture, as it displays high nature-related dependencies and impacts, compared to other agriculture sectors, due to its demand for land and its greenhouse gas emissions. Currently, there are 1.8 million dairy cows in the UK,[3] contributing an estimated 23% of all ammonia emissions from UK livestock[4] and a significant proportion of the nutrient pollution into rivers and watercourses.

There is huge potential for the dairy sector to minimise its impacts on nature and support ecosystem restoration. Livestock can generate significant benefits to grasslands, by supporting nutrient cycling, improving soil fertility and organic matter content, and enabling water infiltration by breaking up solid soil surfaces.[5] To secure these benefits the management of livestock needs to be adapted to each site, which may include optimising the type, number and timing of livestock grazing.[6] By transitioning to a regenerative system, dairy farming has the potential to introduce practices which help to decrease the use of external inputs significantly, while improving the state of nature on-farm. These practices focus on improving soil and biodiversity by minimising disturbance and integrating livestock into mixed and circular systems. The practices included within this report are:

LOWER INPUT:

Regenerative dairy farming relies on thinking about new measures of success other than yield per cow, such as biodiversity gain, carbon stock improvements, and improved water quality and retention. This approach results in significantly lower use of chemical inputs, including fertilisers and pesticides. It also includes focusing on the production of milk from home-produced feed, especially forage, while using less purchased feed, especially imported feedstuffs such as soya.

SOIL HEALTH:

Soil tillage can cause soil erosion, nutrient runoff and greenhouse gas emissions.[7] Additionally, it can add operational costs and increase the complexity of running the farm. Regenerative farming systems tend to minimise tillage to promote good soil structure and boost biological and microbial soil systems. Where crops are grown, this would include minimising soil disturbance and reseeding, maintaining soil cover and practising crop rotation, while using and storing slurries and manures efficiently (with the potential use of soil improvers such as compost).

GRAZING:

Regenerative dairy farming generally aims to optimise the time and efficiency of outside grazing, with year-round housed animals thought to be incompatible with regenerative dairying. Grass-fed cows can produce higher quality milk, with higher contents of omega-3 fatty acids and unsaturated fatty acids.[8] Increased grazing periods can reduce production costs, due to the high cost of feed and the need for slurry storage.[9] There are trade-offs when shifting to out-wintering cattle. A hybrid system of grazing and housing can improve waste management, productivity and animal welfare.[10]

SHIFTING MILKING REGIMES:

Regenerative farms will also focus on less intensive milking regimes to reduce the need for imported feed and other inputs and overheads. Some studies have found twice-a-day milking to be more profitable than milking once or three times a day.[11,12] Likely, a flexible milking regime adapted to the context of the regenerative dairy farm will be the most appropriate and efficient approach.

ADJUSTING COW BREEDS:

Regenerative farmers tend to rear breeds more suited to pasture utilisation and outside grazing. This depends on the type of farm, but certain breeds, such as Jersey cows, tend to require less feed dry matter to produce equivalent quantities of fat and protein.[13]

MAKING SPACE FOR NATURE:

Trees and hedges are important parts of regenerative systems; they diversify the soil cover and habitat and can enhance animal welfare. Trees planted in shelterbelts have been found to improve the productivity and resilience of grazing enterprises.[14] Woodland planting, especially in upland areas, can increase water infiltration and, potentially, reduce flood risk downstream.[15,16] Similar benefits can come from increasing soil cover and permanent root structure. Finally, the introduction of diverse swards, including legumes and herbal leys, can improve biodiversity and carbon sequestration.

KEY BENEFITS

Regenerative agriculture can provide farmers with a more sustainable and resilient business model and is broadly aligned with national climate and nature targets. Below, we outline the key environmental, animal welfare and financial benefits.

ENVIRONMENTAL BENEFITS:

From an environmental perspective, regenerative agricultural practices offer several benefits. They help support and restore soil health and contribute to improving water quality, carbon sequestration, biodiversity and overall ecosystem health.[17,18]

- **Soil health:** Fundamentally, regenerative agriculture aims to improve soil health. Healthy soils can better sequester carbon through an increase in soil organic matter, which also improves the soil's ability to hold water. Furthermore, regenerative practices can help fungal networks to grow, supporting carbon capture and biodiversity such as earthworms, insects and microbes underground. This enables the regeneration of topsoil, which is important for farming and avoiding soil erosion and improving water quality.[19] Studies have also shown regenerative agriculture can improve pest resilience.

- **Biodiversity:** Biodiversity has been found to be higher on organic farms, which tend to align with some regenerative approaches.[20] The application of sprays, especially insecticides, is a major cause of the decline in terrestrial invertebrate species, with wider ecosystem repercussions.[21] Fertiliser use has been linked to species decline due to, among other things, negative impacts on freshwater and coastal ecosystems.[22] Reducing and removing these inputs through a transition to regenerative farming would reduce these negative impacts.

- **Reduced runoff pollution:** Reduced input application and increased soil structure can lower runoff to water courses and the associated water pollution.[23,24,25,26,27] This can reduce the costs to businesses and society as the cost of removal is greater than the cost of prevention.

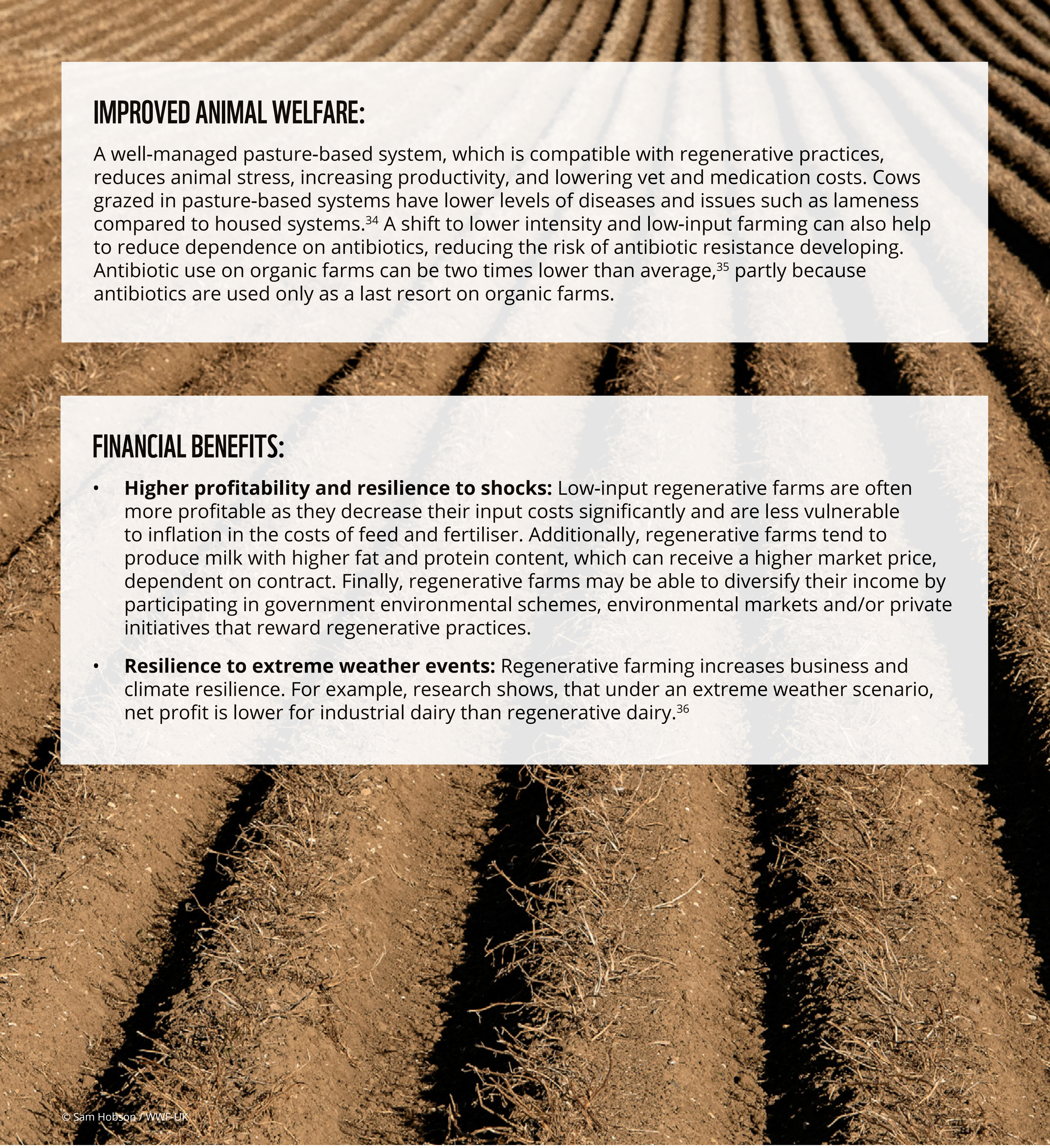
- **Greenhouse gas emissions:** Various regenerative approaches can reduce greenhouse gas emissions and increase carbon sequestration.[28,29,30,31,32,33] This is through reduced input use, increased soil carbon sequestration, and increased storage in biomass such as pasture and trees.

IMPROVED ANIMAL WELFARE:

A well-managed pasture-based system, which is compatible with regenerative practices, reduces animal stress, increasing productivity, and lowering vet and medication costs. Cows grazed in pasture-based systems have lower levels of diseases and issues such as lameness compared to housed systems.[34] A shift to lower intensity and low-input farming can also help to reduce dependence on antibiotics, reducing the risk of antibiotic resistance developing. Antibiotic use on organic farms can be two times lower than average,[35] partly because antibiotics are used only as a last resort on organic farms.

FINANCIAL BENEFITS:

- **Higher profitability and resilience to shocks:** Low-input regenerative farms are often more profitable as they decrease their input costs significantly and are less vulnerable to inflation in the costs of feed and fertiliser. Additionally, regenerative farms tend to produce milk with higher fat and protein content, which can receive a higher market price, dependent on contract. Finally, regenerative farms may be able to diversify their income by participating in government environmental schemes, environmental markets and/or private initiatives that reward regenerative practices.
- **Resilience to extreme weather events:** Regenerative farming increases business and climate resilience. For example, research shows, that under an extreme weather scenario, net profit is lower for industrial dairy than regenerative dairy.[36]



While intensive high-yield dairy farming has negative impacts on nature – including land-use change, pollution, carbon emissions and biodiversity loss – there is potential for the sector to transition to a regenerative system that works for nature and farmers. The dairy sector has an important role to play in the UK's mission to build a net-zero nature-positive economy. Considering the wide range of benefits and challenges, the dairy sector is an ideal case study to model the costs of a regenerative transition.

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2. CURRENT SHOCKS ARE MAKING IT DIFFICULT FOR FARMERS TO STAY IN THE DAIRY SECTOR

Supporting the dairy sector in a just and equitable transition towards nature-friendly and regenerative approaches will drive positive change for both farming and the planet. Industrial dairy farming is facing a number of challenges. The number of dairy farmers in the UK decreased by 4.8% in 2023 compared to 2022[37] and this downward trend is likely to continue: 10% of dairy producers stated they are likely to cease production by 2025, while an additional 23% were unsure if they will remain operational after 2025.[38] The vast majority of farmers attribute their exit from the dairy sector to inflation in input prices, including feed, energy and fertiliser, supporting the arguments for transitioning to a regenerative farming system with reduced energy and chemical inputs.[39] Meanwhile, volatile milk prices and input costs significantly affect the profitability of farms year-on-year, hampering long-term investments and growth opportunities. Notably, the average farmgate milk price dropped by 29.2% in June 2023 compared to December 2022, when it hit a record high.[40]

4.8% of UK dairy farmers ceased production in 2023 alone.

10% of dairy producers stated they are likely to cease production by 2025.

23% of dairy producers were unsure if they will remain operation after 2025.

These pressures on dairy farms are only likely to increase as climate change further takes hold, and indeed the dairy sector is one of the most vulnerable of all farm sectors. The cost of extreme weather to farmers in Wales and Scotland has been calculated at around £335m in 2018 alone, with the dairy sector the most heavily affected single sector due to increases in feed and forage costs.[41] This has a direct impact on farmers' income: net profit for existing dairy farms in Scotland is projected to fall by 19% in an extreme weather scenario, compared to 12% for dairy farms using regenerative practices, showing the relative resilience of more regenerative dairy systems.

Industrial high-yield farming has locked some dairy farmers in the UK in a low-profit business model with limited opportunities to grow and high exposure to climate- and nature-related risks. The transition to a regenerative system can provide some dairy farmers with a more profitable business model, while placing them at the forefront of the national efforts to restore nature in the UK. As illustrated in figures 1 and 2, farmers are operating in an extremely volatile environment. In summer 2022, the prices of many commonly applied fertilisers were 280-400% higher than in 2020. Even though fertiliser prices have decreased since then, they remain significantly higher today compared to 2020 levels (figure 1). Similarly, the prices of straw, hay and diesel experienced a massive increase in 2021 and 2022 and they are still higher today compared to 2020 levels (figure 2). The inflation in the prices of key inputs decreases the profitability of farms as well as their capacity to plan long-term.

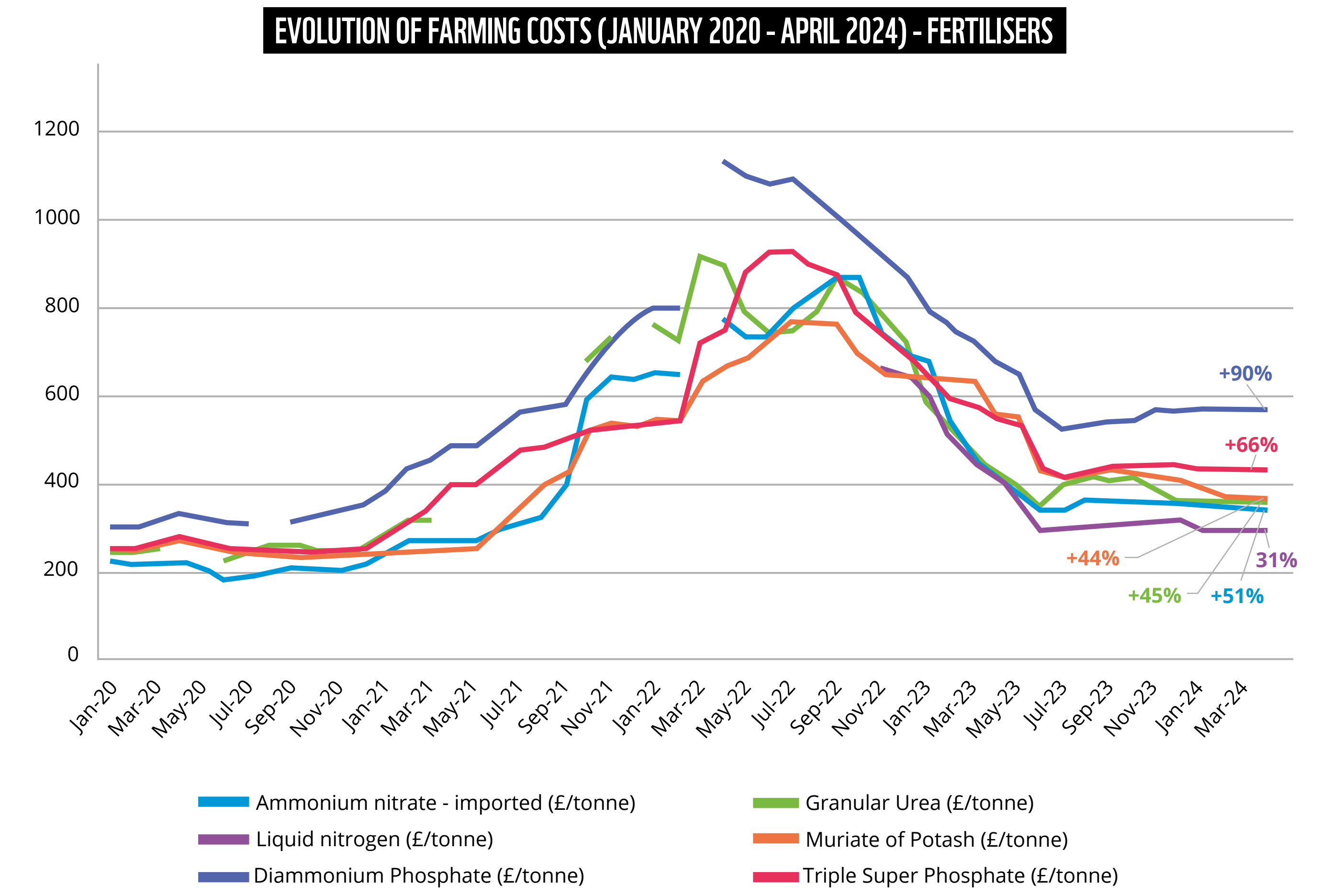

Figure 1 The evolution of fertiliser costs between January 2020 and April 2024 (Source: AHDB datesets)

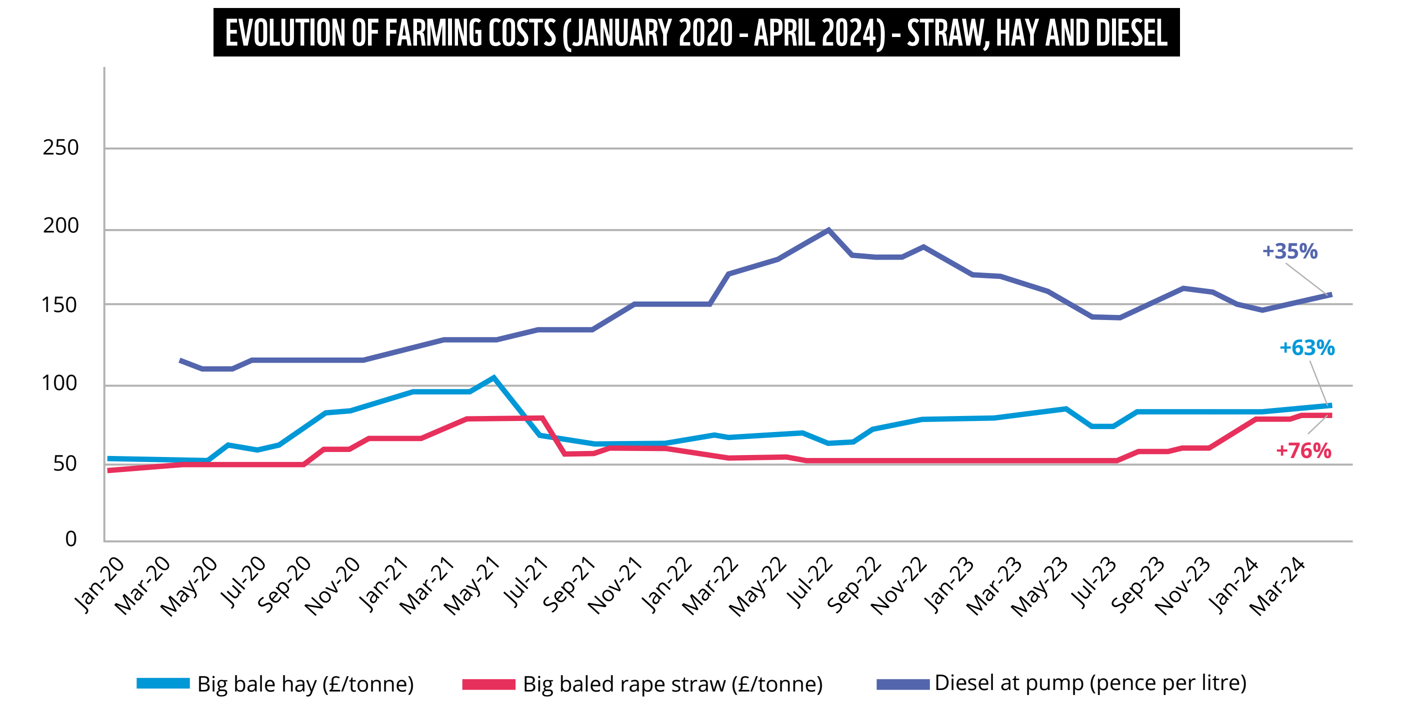

Figure 2 The evolution of the price for straw, hay and diesel between January 2020 and April 2024 (Source: AHDB datasets)

Getting this transition right is critical to support not just farmers on this journey, but also investor and citizen movements for food produced in a way that improves the health of ecosystems, the climate and nutrient quality. Consumers, retailers, and financial institutions are putting pressure on supply chain actors to align their operations with net zero and nature recovery, and many of them have stated that they are prepared to support their farming customers to transition. At the same time, disclosure frameworks for climate and nature at global and national levels are bringing food and farming up the list of priorities for action, recognising that supporting farmers to be resilient to future shocks can reduce threats to supply chains and investments.

Finally, any transition brings change and uncertainty. **A just transition for the dairy sector will not succeed unless the support given to farmers is adequate, long-term and genuine,** so that farmers themselves trust in the system to deliver them a just and fair return. This also will require action to encourage a wider mindset shift in the sector, including fostering dialogue with and between farmers, and incorporating the social risks and opportunities of transition alongside financial and environmental considerations.

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3. USING ECONOMIC ANALYSIS TO ENGAGE STAKEHOLDERS ACROSS THE DAIRY SYSTEM TO SHARE THE COSTS AND RISKS OF TRANSITION

AIM

WWF-UK commissioned Cumulus Consultants and the Andersons Centre to model the cost of the transition of a set of typical dairy farms towards a regenerative farming system by estimating the impact of regenerative practices on the cash flow and profitability of dairy farms in the UK. We define regenerative agriculture as the type of agriculture that focuses on improving ecosystem resilience by reducing the use of energy and chemical inputs, particularly through practices that improve soil health.

This is one step in the journey to transform the agriculture sector in a just and equitable way. The aim is to model the economic transition to stimulate thinking among stakeholders on how they can alter their financial offering to support dairy farmers in the transition – particularly in the upfront years of the fallow period.

The model does not intend to provide recommendations to farmers or other supply chain actors on how to transition towards regenerative agriculture or on how to finance and support the transition. Instead, the analysis is used to demonstrate the following concepts, which provide a foundation for future engagement:

- **Fallow years period:** Dairy farmers can expect the initial stage of the transition to lead to lowered or negative profitability. This is due to investment CAPEX/OPEX costs, as well as lower yields outweighing operational savings in the short term, only partly offset by potential rewards from milk price premiums and agri-environment schemes. However, their profitability is expected to recover at the end of this period, and in many cases post-transition farms are more profitable.
- **Resilience:** Dairy farms that have completed the transition to a regenerative system are likely to be more resilient to price shocks in inputs and milk prices as well as to extreme weather events compared to industrial high-yield farms.
- **Nature and climate benefits:** Regenerative practices enable dairy farms to achieve a balance between food production and land management, which can have a net-positive effect on the environment by sequestering emissions, reviving soil systems, avoiding water pollution and restoring biodiversity.

Overall, the analysis in this report justifies supporting dairy farmers through the short-term ‘fallow year’ period to achieve long-term gains for farmers, climate and nature. However, the process of identifying the level and type of support needed requires further engagement with stakeholders and farms. The findings of this report should underpin this engagement.

SCOPE

The scope of the project includes quantifying dairy farmers' likely financing needs, during the early years ('fallow years') of the transition to regenerative farming and in the years following the transition. Through a cash flow analysis, this project explores the financial journey of three typical UK dairy farms as they adopt regenerative practices.

The analysis in this report is based on a financial model that captures the impact of different regenerative practices on the cash flows of dairy farms. The model distinguishes between three types of industrial farm: fully housed, partly housed and grazed, and extensive grazing. Although this distinction allows us to capture more accurately the effect of the transition on different types of dairy farms, it is important to acknowledge that a transition to regenerative agriculture can take many shapes and forms depending on the starting point of each farm, the priorities of its owners and its location.

The model does not intend to provide recommendations to farmers on how to transition to regenerative agriculture. Average data from a range of datasets was used to build farm types that are broadly representative of the UK dairy farming sector. These are used to illustrate the types of transitions many UK dairy farmers would have to undertake to shift to regenerative farming. However, management, land use, size, performance and numerous other features vary considerably across the UK and not all dairy farms will be perfectly represented. Although the model provides a useful analysis on the transition to regenerative agriculture, it is underpinned by certain assumptions which may not hold true for all farmers:

- **Duration of the transition:** The timescales were selected based on the minimum time required to transition, typically over a five- to seven-year period. Farms could decide to transition over longer periods and to time the changes differently – the principles of regenerative agriculture allow farmers to progress at their own speed, which could be one field at a time. This could reduce the annual costs of the transition by spreading it over more years, however, it would also delay the delivery of benefits (both potential profitability increase, and nature recovery) from transitioning.
- **Timeframe:** Our model focuses on estimating the costs and benefits that occur during the transition to regenerative agriculture, specifically the fallow years of greatest change. This approach enables us to identify ways of supporting farmers during this period when they may need it most. Therefore, we only model costs and benefits for a specified period until the profitability of farms is restored and stabilised, but not beyond that point. As such, we do not capture the potential benefits that may materialise in the medium- and long-term following the transition.
- **Starting bank balance:** The model assumes that farms have a starting bank balance of £0. While some farmers have cash reserves that they could potentially invest in the transition, many already have some level of debt prior to starting the transition. This is not reflected in the model, but can be a barrier preventing farmers from transitioning to a regenerative system.
- **No increase in land area** has been modelled for any of the farms.
- **Change in yields:** In many cases, assuming land area remains equal, milk yields are likely to reduce on regenerative dairy farms due to reduced intensity and input use; this is reflected in the model. For example, organic yields are typically reported to be 25% lower than industrial,[42] though reductions may be less severe in other regenerative systems and the change depends on the transition of each farm. Although there are cases where farmers have managed to maintain constant production while transitioning, for example by increasing the land area or number of cows suited to outdoor grazing, we have not included these options in the model as they are not always available to farmers. Rather than focusing on yield, this study aims to demonstrate that a transition to regenerative dairy farming can improve and maintain profitability at farm level.
- **Crossbreeding:** The model assumes that farmers use crossbreeding when necessary. Some farmers have transitioned more quickly by selling their existing cows and replacing them with a new herd that is better suited to regenerative practices. However, as this option is not always available, we have not included it in the model.

METHODS AND MODEL

MODEL

A review of existing literature, industry data and scientific evidence was undertaken to understand the typical transition from an industrial dairy farm to a regenerative one. Three farm types representing the majority of dairy farms in the UK were defined, first qualitatively and then quantitively using the data outlined below. The farm types are housed intensive, housed and grazed, and extensively grazed. For each of the dairy farm types, annualised management and land-use changes were defined and quantified to explore how it would transition to regenerative farming and the financial changes that would result. This included changes in the farm system and management practices, physical inputs (e.g. fertiliser, forage, feed) and outputs (e.g. yield per cow), and the changes in operational and capital costs.

Profit and loss (P&L) models were created for each of the dairy farm types. The industrial farm types represented the starting point of the transition, while the regenerative dairy farm types represented the end point of the transition. For the intervening transition years, the changes were modelled to understand the requirements for investment, financing and funding over time.

Based on this quantitative analysis, we calculated the change in net income, cash flow margin and profitability due to transition. Sensitivity analysis was carried out to assess how the results would change due to fluctuations in the price of milk, feed and fertiliser.

DATA

There is no single nationwide dataset capturing the transition of dairy farmers to regenerative agriculture. We have, therefore, combined data from multiple datasets to create a representative picture of the transition. The datasets include Farm Business Survey (2021/22) from England,[1] Scotland[2] and Wales;[3] AHDB Dairy Performance Data (2018/19);[4] Anderson's Benchmarking Data (2022); Kingshay Dairy Costings Focus (2023);[5] and budgetary data from ABC-96[6] and the Organic Farm Management Handbook (2023).[7]

1. Defra. 2022. Farm Accounts in England 2020/21 - Dataset. **www.gov.uk/government/statistics/historic-farm-accounts-in-england**
2. Scottish Government. 2022. Scottish farm business income: annual estimates 2020-2021. **www.gov.scot/publications/scottish-farm-business-income-annual-estimates-2020-2021/documents**
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6. Agro Business Consultants Ltd. 2023. The agricultural budgeting and costing book No. 96, May 2023.
7. Organic Research Centre. 2023. Organic Farm Management Handbook 2023.

KEY ASSUMPTIONS

The model is based on conservative financial assumptions, based on current levels of available support and recognising that more support is needed:

- Key prices and costs used in the models are based on five-year averages. Given the lower weight of input costs in total operational costs in regenerative farming (compared to industrial models), using recent input prices (instead of the five-year average) would show an even higher financial advantage for farmers to transition toward regenerative models.
- Existing support is based on average agri-environment support and grants across the UK.
- Additional support that becomes available as the farms transition to regenerative farming is largely based on England's Environmental Land Management (ELM) scheme. This is because it is the most developed of the agri-environmental schemes in the UK.
- The model only covers the actual period of the transition (5-7 years), so it does not capture any long-term benefits that are likely to accrue.
- Basic Payment Scheme payments have been excluded due to uncertainty around the future of this payment scheme across the UK.
- Revenues exclude any potential additional supply chain funding, additional government support or diversified income from carbon and nature markets or other farm businesses.
- Farm income pre-transition excludes any additional funding, such as market-based premiums, government support, private sector payments or diversification on farm.

The model includes the following conservative assumptions on the financial support available to farms:

- **Milk price premium:** Based on the assessment of current 'regenerative premiums', the modelling applies a premium of 1.5 pence per litre to all milk sold from day one of the transition as additional regenerative funding. Although premiums of this level are available to some farmers, they have not yet become an industry norm and supply chain actors need to mobilise to make price premiums widely available to regenerative dairy farmers.
- **Agri-environment:** Baseline farm profitability includes agri-environment payments based on rates reflected in UK-wide Farm Business Survey (FBS) data. This data is robust but fails to consider the increased agri-environment payments that are likely to occur in the support schemes that will replace the EU Common Agricultural Policy. Projected additional agri-environment payments were modelled for each transition based on the applicability of recently developed options to each farm and the changes made. This approach makes available between £73 and £87 per hectare in additional agri-environment income depending on farm type.
- **Environmental markets:** The model does not currently include any environmental market payments.
- **Loans and overdrafts:** The model assumes that demand for loans stays the same and they will be repaid based on averages from FBS datasets. It assumes a starting bank balance of £0. All working capital through transition is paid for via an overdraft style of funding. Calculations were based on a base rate of 5.25% and a margin over base of 1.5%, giving a total of 6.75% interest on overdraft.

TYPES OF DAIRY FARM TRANSITION

Table 1 shows the different transitions for the three industrial dairy farm types to regenerative farm types. We assume a minimum of seven years for the housed intensive transition and the partly housed and grazed transition, mostly due to the length of time needed to change the breeding within the dairy herd. The extensive grazing transition is assumed to take five years, which allows time for pasture seeding.

Table 1: Transition of dairy farm types

CONVENTIONAL DAIRY FARM TYPE		REGENERATIVE FARM TYPE
Housed intensive (AYR)	↘	
Partly housed and grazed (AYR)	→	Regenerative housed and grazed (AYR)
Extensive grazing (BC)	→	Regenerative grazed dairy (BC)

AYR = All year round calving BC = Block calving

NOTE ON THE TRANSITION OF FULLY HOUSED SYSTEMS

The starting point and the technical performance for each farm type is different, as there are a range of management choices to get to a regenerative farm model. The analysis assumes that a fully housed farm needs to transition to a partly housed and grazed system. This assumption is based on engagement with the dairy sector, which revealed that some level of grazing would be required for a dairy system to be regarded as regenerative. This aligns with the regenerative principle of integrating livestock into mixed rotation systems. Grazing can also help to ameliorate the issues around slurry management, bought-in feed and fertiliser associated with all-year-round housing. Large milk buyers investing in regenerative farming (including Arla, First Milk and Yeo Valley) all stipulate some grazing for farms if they are to be considered regenerative.

For some large dairy farms in the UK with housed intensive systems it is currently unfeasible to move to a grazing system – for example, where the land where the forage is grown is distant or inaccessible from the cattle sheds.

The full set of assumptions for all three types of transitions is outlined in tables 6-2, 6-4, and 6-6 in the technical annex. The process and journey of how and when one farm transitions to the other is described in tables 6-3, 6-5, and 6-7 in the technical annex.


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4. RESULTS FOR THREE TYPES OF DAIRY FARMS

An important finding is that **all three types of dairy farms are profitable at the end of the transition,** even under conservative assumptions about access to financial support. Even more encouraging is the fact that two of the farm types, **extensive grazing (type 3) and housed intensive (type 1), end up more profitable at the end of the transition than they were before.**

Even with the limited support that is currently available to dairy farmers, in most cases farms post-transition display higher Operational Profit and Operational Cash Flow Margins compared to pre-transition. Importantly, all three farm types also appear to be more resilient to fluctuations in milk, feed and fertiliser costs. This is a clear indication that a regenerative transition in the dairy sector can deliver higher profitability and greater resilience to external shocks, such as the current spike in global fertiliser and fuel prices, alongside environmental and welfare benefits.

The knowledge that regenerative dairy farms can be profitable and resilient provides a promising starting point for further engagement to identify suitable mechanisms to support the transition of the dairy sector. We intend to use the results of the model to co-create solutions and recommendations with dairy farmers and other supply chain actors.

However, it is also evident that **farmers need to be provided with significantly more support from the government and other supply chain actors to complete the transition.** The cost of the transition, especially in its early stages, as well as the associated risk is likely to deter many farmers. Indeed, the partly housed and grazed systems (type 2) are expected to be less profitable at year 7 relative to year 0, although this does not account for the likely impacts of extreme weather, and trends indicate that these farms could exceed year 0 profitability in the future.

It should be noted that **these results are based on a set of conservative assumptions.** During the modelling period, milk prices had decreased significantly following their peak in Q1 2023. Additionally, to ensure that we modelled the costs of the transition accurately for all types of farms, regardless of their situation at the beginning of the transition, we assume a starting bank balance of £0. Dairy farms that hold more cash at the beginning of the transition would potentially need to borrow less money and thus face lower repayment costs. Finally, we do not include any basic, or area-based, payments currently being phased out as part of the UK's transition away from the Common Agricultural Policy, and we assume that dairy farms do not yet receive any environmental market payments, or other forms of support from the supply chain except for price-based incentives.

KEY TERMS

- **Total Revenue:** Any farming and non-farming revenue, including but not limited to milk sales, crop sales, and agri-environment income.

- **Operational Profit:** Farm income from operational activities before financial costs under new debt
  - *Operational Profit = Total Revenues - Direct Costs - Overheads costs (excluding depreciation)*

- **Operational Cash Flow:** Farm cash flow generated from operational activities, including operational capital expenses (e.g. Installation of cow tracks, machinery purchases)
  - *Operational Cash Flow =Operational Profit-Taxes- Capital expenditures + Capital income*

- **Operational Profit Margin:** Measures profit from operating activities as a percentage of sales revenue
  - *Operational Profit Margin = (Operational Profit)/(Total Revenue)*

- **Operational Cash Flow Margin:** Measures cash from operating activities as a percentage of sales revenue
  - *Operational Cash Flow Margin = (Operational Cash Flow)/(Total Revenue)*

TYPE 1: 'HOUSED' TRANSITION

PROFILE – FULLY HOUSED FARM

The baseline 'housed' farm – The industrial housed dairy farm type is assumed to be a relatively large dairy farm (194 ha), with the land being used for silage, feed crop and cash crop production. Cows are housed inside all year round and fed silage and concentrates.

This farm is likely to have substantially higher overheads than the average UK dairy farm, due to high labour costs and high power and machinery costs to feed and milk the housed cows, produce and bring in silage and feed, and remove and spread slurry.

The target regenerative farm – The housed farm transitions to a regenerative dairy farm with a mix of pasture-grazed and housed cattle, with feed and bedding grown on the farm. Cattle are rotationally grazed, moved every four days during the summer and off the pasture over the winter. The farmland is split into paddocks for grazing and land used for feed crops and forage production. The farm may need to invest in regenerative machinery to manage crop rotation, such as direct drilling equipment. Housing would be focused on circularity, improved slurry storage and usage, and use of low-input homegrown feed and bedding.

Changes in investment – Moving from a housed dairy farm to a farm with a greater proportion of grazing requires a considerable change in management. Besides the land use and management changes outlined above, this will include a range of investments such as:

- **Infrastructure –** cow tracks, fencing, water pipes and troughs will likely be needed for the farm to support an increase in grazing. On the other hand, housing and the dairy parlour will be used less intensively than before the transition, which may reduce depreciation.
- **Machinery/equipment –** this might include electric fencing and direct drills that help the rotations to be managed regeneratively.
- **Training/advice –** the farm may need to invest in training and change the advisory services it uses to effectively transition to the new management style.
- **The farm may be able to free up housing space for diversification,** such as opportunities for storage or facilities for small businesses. These opportunities are likely to be very context specific and varied and have not been modelled.

RESULTS

The housed-intensive transition generates the healthiest levels of Operational Profit and Operational Cash Flow Margins, after the transition. Total revenue, Operational Profit and Cash Flow drop during the first years of the transition, driven by the significant changes from a housed farm approach to integrate grazing. Following the transition, however, Operational Profit and Cash Flow are expected to be 33% and 150% higher, fuelled by a milk premium of 1.5 pence/litre and agri-environment government support. The investment needed for the farm to transition is estimated at around £200,000 (net from cow sales and capital grants). For modelling purposes, this is shown as fully absorbed by the farm's cash account, but in reality, would be covered by bank debt unless other financial support is made available.

In figure 3, we observe how the Operational Cash Flow Margin (orange line) of a housed-intensive farm is significantly higher post-transition compared to pre-transition (2% pre-transition against 7% post-transition). This is a strong indicator that, despite a decrease in Total Revenues driven by a less intensive model, the modelled farm is more efficient at turning revenues into Operational Cash Flow. Similarly, the Operational Profit margin increases to 20% post-transition compared to 9% pre-transition, which indicates the improved capacity of the farm to convert revenues into profits.

FULLY HOUSED (£K)

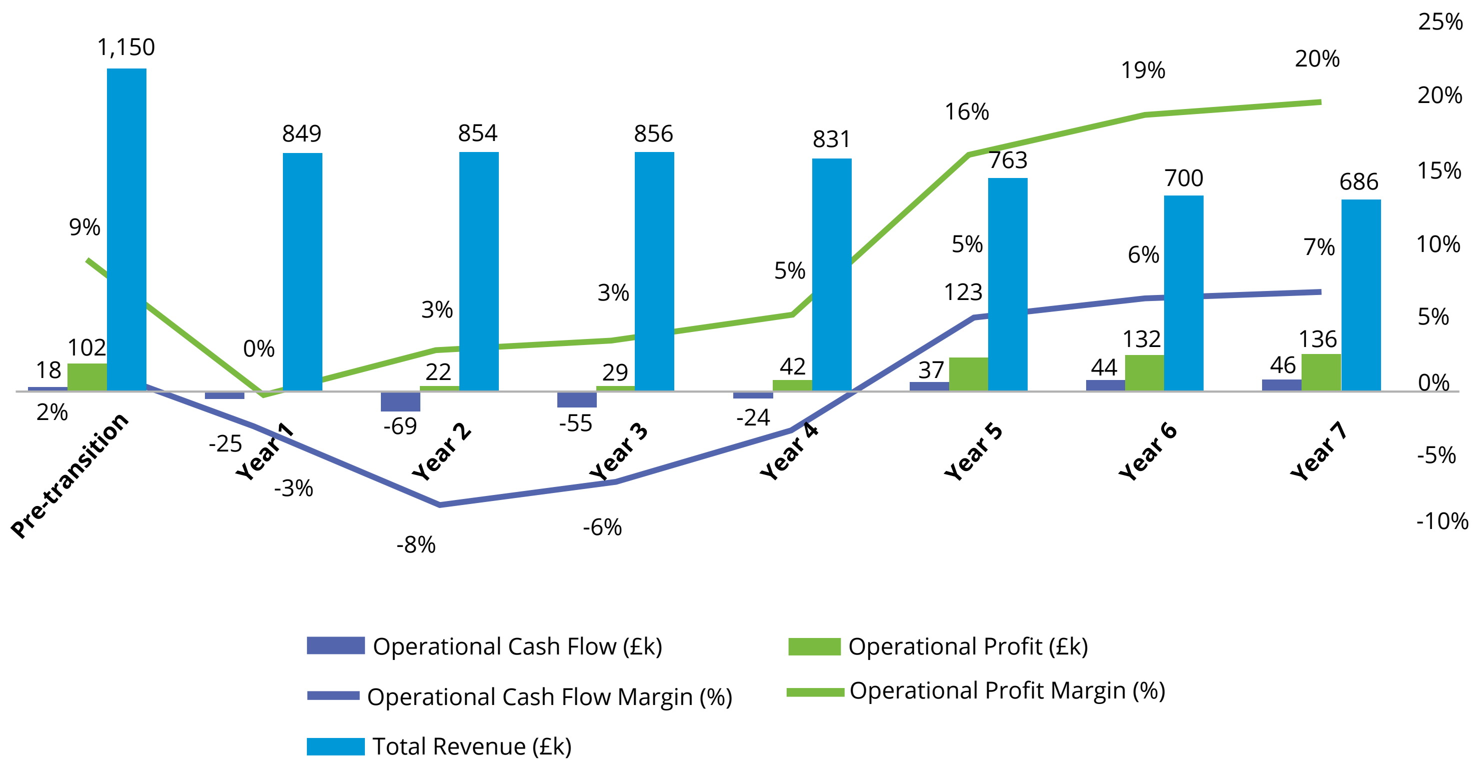

Figure 3 - Cash flow profile for a housed-intensive farm system transition

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TYPE 2: PARTLY HOUSED AND GRAZING TRANSITION

PROFILE – PARTLY HOUSED AND GRAZING

The baseline 'partly housed and grazed' farm – The industrial 'partly housed and grazed' dairy farm type is representative of the typical UK dairy farm of about 167 ha. It is based on an all-year-round calving dairy herd with cows being grazed for part of the year and housed for the winter.

The target regenerative farm – The regenerative equivalent is similar to the regenerative dairy farm described in the type 1 transition above (but of a smaller size), with cattle grazed on low-input pasture for most of the year and housed during the winter months.

Changes in investment – In this transition, the regenerative farm continues grazing, cropping and housing cows for a portion of the year. This means that the equipment, machinery and infrastructure on the farm will not change drastically. Some additional investment in training and a change in advisors will be needed.

RESULTS

In many ways the partly housed and grazed transition is the most challenging. Even with current agri-environment government support and price premiums, this farm type does not attain higher Operational Profit at the end of the transition relative to year 0. The investment needed for the farm to transition over seven years is estimated at around £120,000 (net from cow sales and capital grants). For modelling purposes, this is shown as fully absorbed by the farm's cash account, but in reality would be covered by bank debt.

The drop in profitability occurs because initial management intensity is lower than in the housed-intensive transition, meaning there is less capacity to reduce costs (especially overheads). The farm also has less cropland available than the housed-intensive farm, so is less able to produce homegrown feed. On the other hand, the management of the final regenerative farm is more intensive than is reached at the end of the extensively grazed transition. Again, this means lower cost reductions.

As illustrated in figure 4, partly housed and grazed dairy farms are expected to experience a marginal improvement to their Operational Profit margin (18% post-transition compared to 15% pre-transition). However, the Operational Cash Flow margin is expected to decrease by 1 percentage point post-transition. This indicates that although partly housed and grazing systems regain profitability post-transition and have improved capacity to convert revenues into profits, their profitability is expected to be lower than before. These farmers will need support to make regenerative agriculture work for them. Additional support for farmers would also help accelerate the point at which farms regain profitability, reducing the duration of the fallow years period.

While profitability decreases significantly between year 0 and year 5, positive momentum picks up from year 6. In year 6, Operational Profit increases by 138% compared to year 5, and then again by 21% in year 7 compared to year 6. Overall, the Total Revenue of partly housed and grazed farms are expected to be 20% lower in year 7 compared to pre-transition, but Operational Profit and Cash Flow Margins are 2% higher, due to a lower dependence on external inputs and fertilisers. It is probable that profitability continues to increase after year 7, especially if the farm is also more resilient to extreme weather events; further analysis beyond the scope of this model would be needed to verify this.

Clearly, there is a need for additional long-term support for the dairy sector if these farms are to be effectively incentivised to transition. This could include ongoing payments for regenerative whole-farm management, low-input payments, or expansion of high integrity environmental markets, schemes and standards that can be made accessible to the majority of dairy farms.

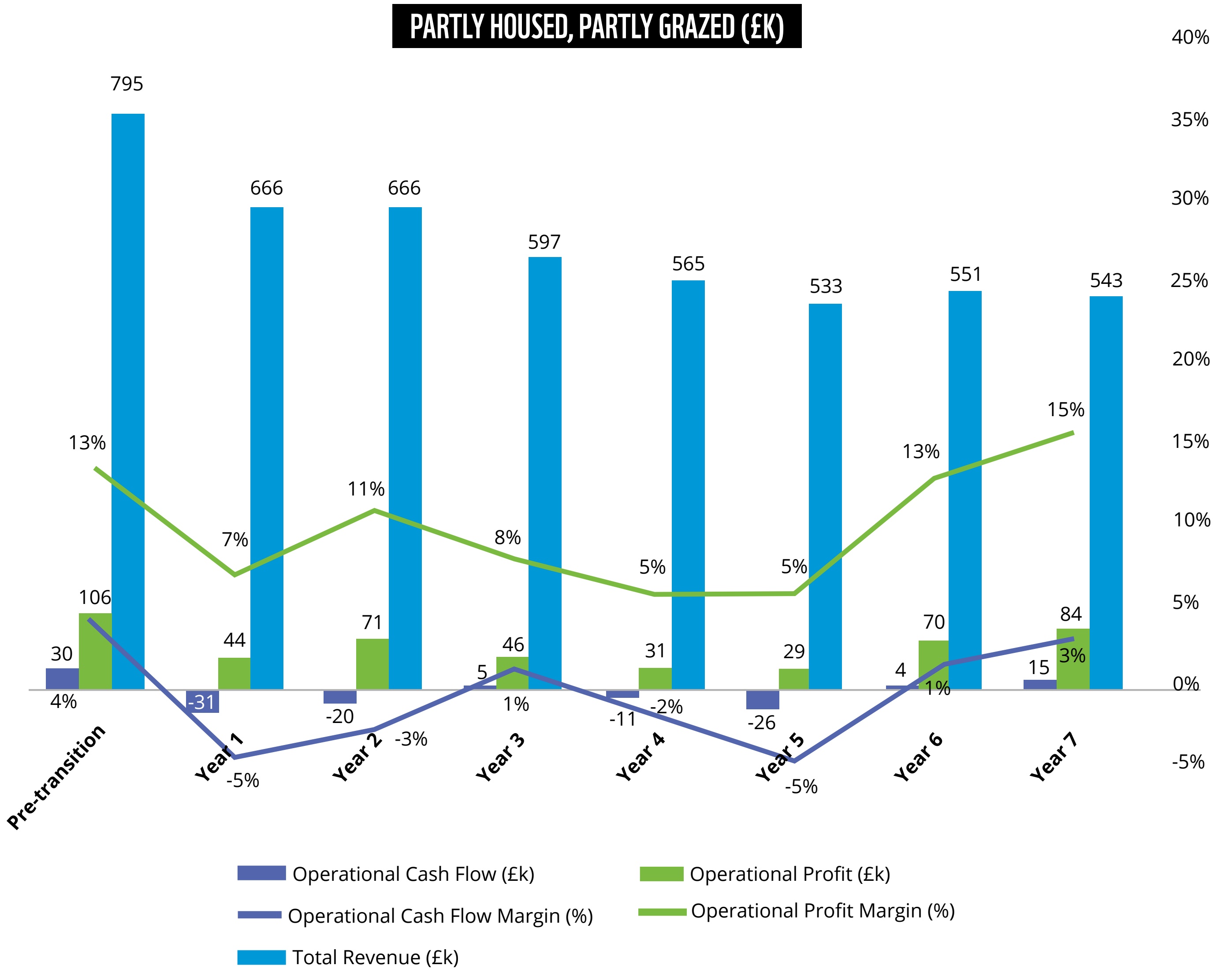

Figure 4 - Cash flow profile for partly housed and grazing transtion.

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TYPE 3: EXTENSIVE GRAZING TRANSITION

PROFILE – EXTENSIVE GRAZING

The baseline 'extensive grazing' farm – The industrial 'extensive grazing' type represents a smaller dairy farm (88 ha) aiming to maximise the output from its pasture. It includes high fertiliser use and silage production with livestock grazed for a longer than average portion of the year. Crop production is low and the farm instead relies more on bought in concentrates.

The target regenerative farm – The regenerative equivalent grazes spring-calving cross-bred cows outside for as much of the year as feasible. Mob-grazing occurs with daily moves in the summer and less frequent (~every four days) in the winter. A flexible milking regime helps support the grazing rotation and reduces pressure on the lower-yielding cows. Herbal leys are grown on the temporary pasture, which helps to improve soil health. Feed imports are kept low and no or low inputs are used on the farm.

Changes in investment – Moving from an industrial extensively grazed dairy farm to a regenerative one requires a shift in management, largely aimed at minimising costs. Besides the key land-use and management changes outlined above, investment in additional machinery will be low while reduction in machinery needs is likely:

- **Infrastructure** – the farm is likely to have most of the infrastructure for grazing already in place.
- **Machinery/equipment** – the farm may need some new electric fencing to manage the grazing. Alternative/portable water troughs might also be needed. The need for cultivation is removed and the farmer will likely be able to sell some of this equipment.
- **Training/advice** – the farm may need to invest in training and change the advisory services it uses in order to effectively transition to the new management style.

RESULTS

The investment needs for the regenerative transition are likely to be lowest on extensively grazed dairy farms. The transition will be shorter and the changes less drastic as the breed, grazing management and infrastructure remain similar but managed less intensively. With the additional funding, the modelled cumulative investment needs to transition would be £60,400 (~£700/ha) over three years; after proceeds from cattle sales and grant payments, this investment need would stand at £24,000. From the fourth year onwards, the farm becomes more profitable than before the transition. In this case, it takes five years to move to a new 'steady state': at the end of the five-year transition, fully grazed farms using regenerative practices are 13% more profitable compared to pre-transition (year 0).

As illustrated in figure 5, both the Operational Profit and Cash Flow Margins are improved after the transition. The Operational Profit Margin, depicted with the yellow line below, measures how much profit a company made in a given year as a percentage of Total Revenue. The increase from 9% pre-transition to 14% in year 5 indicates that operating expenses take up less of the profits in farms that have transitioned to a regenerative system. The Operational Cash Flow Margin, depicted with the orange line, indicates that farms that have transitioned are more efficient at converting their revenues into cash (5% post-transition against 3% pre-transition). Although the Total Revenue of the extensive grazing farm may decrease during the transition, its capacity to generate profits and cash improves. The additional drop in cash flow in year 2 is largely due to the initial costs and lost forage as the pasture is reseeded. This means additional feed needs to be bought in during the early years before profits recover and stabilise in year 5.

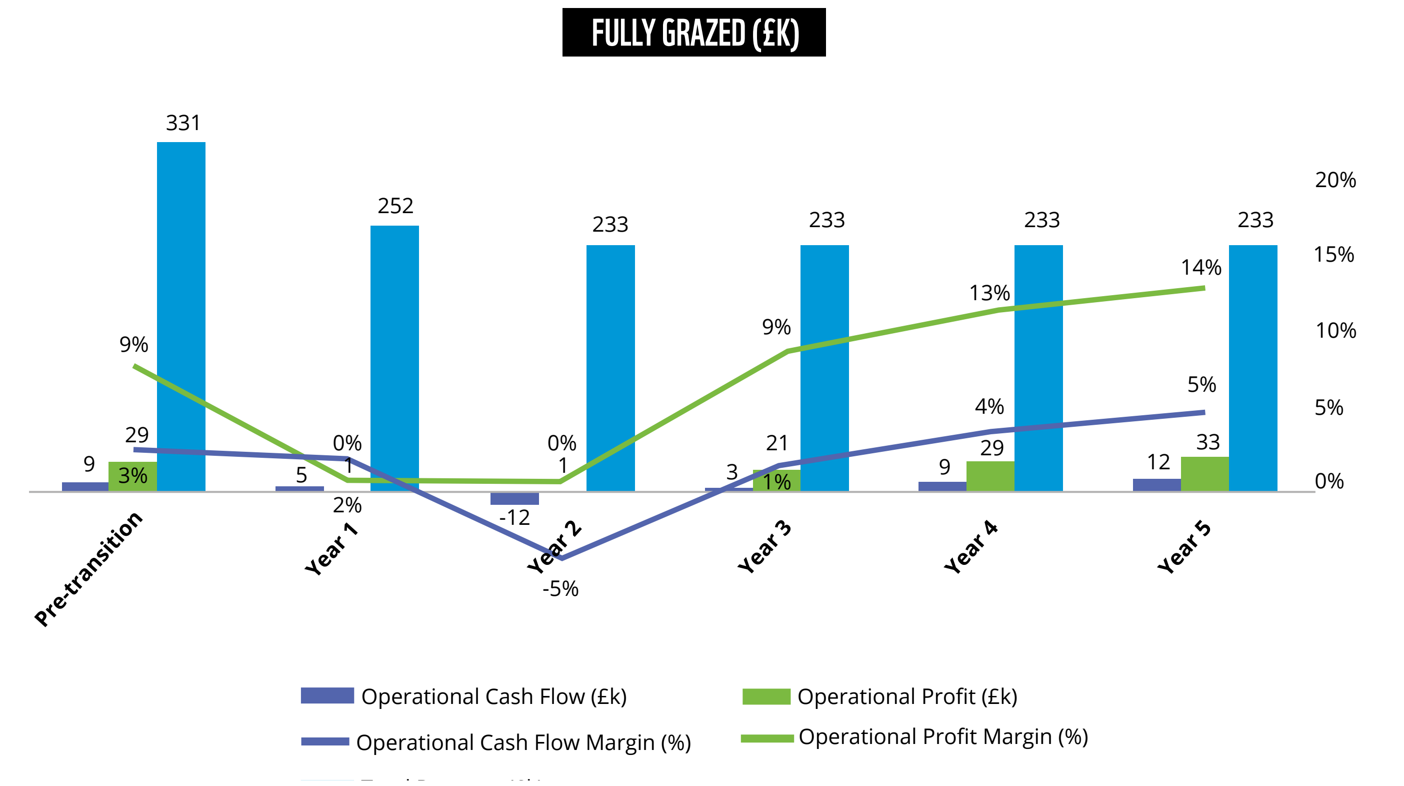

Figure 5 - Cash flow profile for the extensive grazing farm system transition


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SENSITIVITY ANALYSIS

Finally, the sensitivity analysis on the impacts of fluctuations in the price of milk, feed and fertiliser indicates that all three types of farms respond better to negative shocks in prices post-transition, compared to pre-transition. As shown in table 2, the Operational Profit is significantly higher for both housed farms and extensive grazing farms post-transition, in spite of any negative shocks to the price of milk, fertiliser and feed.

The impact of changing milk prices is particularly interesting, since this is the primary form of income at the current time, on which farmers in intensive systems are particularly dependent. It is also the main mechanism that the supply chain currently uses to incentivise regenerative dairy production. All transitioning farms become less sensitive to milk price change over time, with the most dramatic change in sensitivity experienced across the housed transition. For example, the Operational Profit for an industrial fully housed farm reduce by £102,000 (falling into negative profit) if milk prices fall by 10%, but only by £57,000 under a regenerative system (from a higher amount), meaning that a regenerative system remains profitable even with a fall in milk prices, while its profits relative to an industrial housed system become even greater. Conversely, high milk prices may widen the initial profit gap between industrial and regenerative systems, discouraging farmers from transitioning to a regenerative system. This is an indication that the supply chain should be wary of only using price premium incentives to drive positive change and should also use other forms of upfront investment and contracting to support their farmers. The housed intensive transition is the most sensitive to milk price variation due to the high output from the farm in year 0. This makes the business in year 0 very sensitive to milk price fluctuation, with a corresponding impact on the transition.

The partly housed and grazing farm and fully grazed types also respond better to a 10% decrease in milk prices post-transition, with partly housed regenerative farms delivering an Operational Profit 10% higher than industrial ones (vs 20% lower without negative shocks), and partly grazed industrial farms showing a net income £14k higher than industrial ones.

The resilience of regenerative farms to spikes in fertiliser and feed prices also demonstrates the benefit to dairy farms of a model that is less dependent on external and often imported inputs. All types of farms are more resilient to a 10% increase in fertiliser prices, with the fully housed model showing the biggest difference (-30% in Operational Profit after the shock for industrial farms vs only -11% for regenerative farms).

The difference is even larger when the negative shock is a 10% increase in feed prices: industrial farms' Operational Profit decreases by 33% to 49% (depending on farm type), compared to 18% to 25% for regenerative farms.

Table 2 - Sensitivity analysis of different dairy farm systems to changing milk, fertiliser and feed prices, pre- and post-transition to a regenerative state

TYPE OF INDUSTRIAL FARM - OPERATIONAL PROFIT (K£)	SCENARIO	PRE-TRANSITION	Δ VS BASE CASE	POST-TRANSITION	Δ VS BASE CASE	Δ VS PRE TRANSITION
Fully housed	**Base Case**	**102**		**136**		33%
	-10% milk prices	-0	-100%	79	-48%	n.m.
	+10% fertiliser prices	97	-30%	135	-11%	39%
	+10% feed price	71	-49%	125	-18%	76%
Partly housed, partly grazed	**Base Case**	**106**		**84**		-20%
	-10% milk prices	34	-73%	37	-63%	10%
	+10% fertiliser prices	102	-17%	82	-18%	-19%
	+10% feed price	83	-33%	75	-25%	-9%
Fully grazed	**Base Case**	**29**		**33**		16%
	-10% milk prices	-2	-106%	12	-69%	n.m.
	+10% fertiliser prices	27	-25%	32	-19%	21%
	+10% feed price	22	-39%	30	-24%	40%

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5. THE BIGGER PICTURE – LOOKING BEYOND THE MODEL

The model provides a useful indication of the cost of the regenerative transition for the average dairy farm in the UK, and illustrates the need for investors, policymakers and businesses to shift financial flows at scale. However, it does not capture the unique journey that each farmer has to follow. Farmers can choose to transition 'cold turkey' by implementing all intervention at once in year 0, as assumed in the model, or to stagger the transition field by field, intervention by intervention.

To capture the nuances of the regenerative transition, WWF is publishing the Fallow Years report alongside a series of case studies of dairy farmers in the UK who are transitioning to a regenerative system. The case studies reflect the different reasons that motivate dairy farmers to transition, which range from improved work-life balance to building a resilient farming system for the next generation. However, they also reveal that transitioning to a regenerative system makes financial sense and is also a business decision. The results of the case studies and the model complement each other well, as together they demonstrate that the transition to a regenerative system can result in healthy and sustainable farms, as long as the risk of the transition is distributed equitably across the supply chain. The case study report and the associated videos are available on the **WWF-UK website**.

There are important initiatives in the dairy sector focused on building a strong and regenerative system. First Milk, a regenerative dairy cooperative owned by British family farms, brings forward a strong case on how regenerative dairy farms can be deployed at scale. In its latest financial statement, it reported an increase in profitability as well as in the number of regenerative interventions introduced by its farmers.[43] Some farms in the cooperative are reported to outperform the results of our model, regaining profitability sooner than estimated here. While this is important progress, a lot of work still needs to be done to ensure that dairy farmers in the UK receive the support they need to build resilient and sustainable businesses that deliver benefits for nature.


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6. CONCLUSION – PROPOSAL TO CO-CREATE AN APPROACH FOR SUPPORTING FARMERS THROUGH THE TRANSITION TOGETHER WITH OTHER SUPPLY CHAIN ACTORS

The analysis presented above demonstrates that the transition to regenerative dairy farming can result in a profitable business model with resilience to input and milk price shocks. In certain cases, farms can be expected to be more profitable post-transition than they were before. However, dairy farmers should expect a drop in their yields and profitability in the early stages of the transition, which exposes them to significant risks. The transition will be particularly challenging for certain types of farms, as well as for farmers who are already in debt or locked into their existing system. This highlights the need for supply chain actors – including retailers, processors, financial institutions, insurers and government – to co-develop with dairy farmers financing propositions that can incentivise and support the farmers to invest into the transition.

The economic analysis in this report aims to stimulate thinking on how stakeholders can co-develop a blended finance approach that distributes the costs and risks of the transition across the dairy system. We are committed to engaging with farmers and stakeholders to co-develop suitable solutions.

We encourage all stakeholders to consider:

- The timeline of the transition for dairy farmers and the evolving profile in terms of profitability, yields and resilience benefits.
- The differentiated type of financial support dairy farmers need at each stage of the transition.
- What financial instrument is best suited to support farmers at each stage of the transition and who is best placed to provide it – in other words, what is the blended finance model that will work for farmers?

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