BRITISH ECOLOGICAL SOCIETY

Regenerative Agriculture in the UK

An ecological perspective

Summary report

Through science we can

Our five principles of regenerative agriculture

1. Minimise soil disturbance where appropriate
2. Minimise bare soil and keep living roots all year round
3. Increase diversity on the farm
4. Integrate livestock or approaches that deliver the same functions
5. Reduce synthetic inputs and favour ecological approaches

Regenerative agriculture: Three-tier definition

Tier 1: OBJECTIVES
What regenerative agriculture wants to achieve

Tier 2: PRINCIPLES
General guidelines to have in mind when deciding on land management

Tier 3: PRACTICES
Specific actions/techniques to implement that follow the principles and achieve the objectives, adapted to the context of the farm

> "Regenerative agriculture is quite simple: it is any form of farming, i.e., the production of food or fibre, which at the same time improves the environment. This primarily means regenerating the soil. It's a direction of travel, not an absolute."
> *Groundswell Agriculture Ltd*

> "I suppose the takeaway from me from that was it certainly hasn't done any damage. In year one we had a significant, I think about a 45% reduction in our establishment costs because we did a lot less, a lot less cultivation."
> *Mark Coulman*

> "An approach to farming that uses soil conservation as the entry point to regenerate and contribute to multiple provisioning, regulating and supporting ecosystem services, with the objective that this will enhance not only the environmental, but also the social and economic dimensions of sustainable food production.[1]"
> *Schreefel et al.*

> "...with different soils, different environments, you'd apply these tools differently. Regenerative agriculture is based entirely on enhancing life – it's about maximum diversity above and below ground. Maximising life and biodiversity on your farm by managing for your ecosystems processes."
> *Silas Hedley-Lawrence*

> "I first heard of regenerative agriculture about a decade ago, and understanding it has 'lit a lightbulb' and brought everything together... [I] always have the principles in the back of my mind."
> *Doug Christie*

1. Schreefel, L. et al. (2020). Regenerative agriculture – The soil is the base. Global Food Security. DOI:10.1016/j.gfs.2020.100404

Foreword

Jake Fiennes

In my 30-year career working on large rural estates, I have seen the effects farming has had on our natural capital; from the soil beneath our feet, the water in our rivers, to the nature that shares the space in which we produce food. The intensification of food production and the ability to increase yield has happened with little or no consideration for the wider environmental impact. We ploughed, we sprayed, we shortened our rotations and left no time for the land to breathe. And we witnessed an increase in pests and diseases that, overtime, became immune to the products we produced to control them.

> "We ploughed, we sprayed, we shortened our rotations and left no time for the land to breathe"

How can we provide for an ever-growing global population and develop a system that works alongside nature; a system that has a set of principles that effectively mimics nature whilst still providing our food?

The organic movement began in the 1940s as a reaction to agriculture's growing reliance on synthetic fertilisers and pesticides. It had all the potential but delivered little in terms of uptake: yields were low and premiums were high. It also came with a set of daunting standards and regulations. For the majority of farmers, intensive agriculture (or conventional) was just too attractive with its high yields and low cost (initially) for inputs. A term I have heard from many a farmer is 'Yield is king.'

A little after the turn of this century, the concept of regenerative agriculture started to gain a foothold. It appealed to farmers and growers looking for alternative ways to grow food in an ever-changing climate that was less reliant on large amounts of synthetic inputs and worked in synergy with nature. For many, the primary goal was ensuring that their soils were alive and functional with the ability to hold moisture in drought but also drain freely in flood. A food system that could be available to all but had the flexibility to be adapted to individual circumstances; a system that didn't see a loss in yield.

> "A food system that was available to all but had the flexibility to be adapted to individual circumstances"

For the first time in years, farmers talked to one another about what worked and what didn't; learning from each other's experiences and adapting for their own farms. With a set of objectives, principles and practices, regenerative agriculture can be flexible and adaptable to individual circumstances. This enthusiasm from farmers has captured the imagination of politicians and policy makers where we now see support for best practise and alternative methods.

Regenerative agriculture is not a new form of agriculture, it is about learning from the past and implementing for the future. We have a once in a generation opportunity to create a food system that is fit for people, place and planet with actions that are backed by robust science and ecological expertise.

> "For the first time in years, farmers talked to one another"

Executive summary

> “As the global need for sustainable food production intensifies, regenerative agriculture as a concept has become politically and economically loaded”

The 2023 *State of Nature* report confirmed farming as a leading cause of habitat loss and species decline in the UK, on a par only with climate change. That same year, an inquiry by the House of Commons Environmental, Food and Rural Affairs Committee found that current approaches are putting the future of our soils at serious risk, making change ‘critically important’.

Scalability, affordability and productivity are key considerations in any vision for a more ecologically sound food system. For increasing numbers of advocates, regenerative farming could be the answer; a farmer-led movement with a focus on protecting the integrity of the soil, producing food that is profitable, and increasing farmland wildlife.

Yet as the global need for sustainable food production intensifies, regenerative agriculture as a concept has become politically and economically loaded, with accusations of insufficient scientific evidence and concerns around a lack of a formal definition. Similarly, multinational brands presenting regenerative agriculture as part of their corporate sustainability programs have come under increasing scrutiny from farmers and NGOs.

This summary report – based on a much longer academic report from a team of over 40 ecologists with contributions from farmers across the four nations – assesses the regenerative approach to soil health, biodiversity and minimising environmental damage. This task is complicated by the fact that every farm is different – from geology, ecology and climate, to the expertise of the farmer and the resources available.

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There are inevitable trade-offs. Regenerative agriculture promotes a reduction of inputs to reduce costs and externalities but this has the potential to cause reductions in commercial yields. The integration of livestock into mixed farming systems necessitates consideration of the environmental issues associated with animal agriculture, including methane emissions. Finally, reduced tillage, a key principle of regenerative agriculture, can result in an increased weed burden, with some farmers – particularly within arable systems – turning to glyphosate use in place of the plough.

Each of the UK’s four nations have been developing agri-environment schemes following the UK’s departure from the European Union. Further research and collaboration is required to ensure that the benefits associated with regenerative agriculture can be delivered at scale across the four nations in ways which will appeal to farmers and reflect the ecological needs of the UK’s varied landscapes.

Regenerative agriculture has succeeded in harnessing farmers’ existing relationship with the land and looks to forge a renewed sense of stewardship that envisions a future of landscape regeneration, rather than being satisfied by the mediation of harm.

Headlines

- There is good evidence that soils and biodiversity can improve under regenerative farming systems. In particular, the principle of minimising bare soil and keeping living roots all year round has a positive impact on soil health and biodiversity.
- Evidence is less strong around some of the benefits associated with no-till or minimum till, despite its prominence as a principle of regenerative agriculture.
- The reduction in inputs associated with regenerative agriculture has both ecological and economic benefits, with improvements in ecosystems services potentially mitigating the impact of such approaches on yield.
- A whole systems approach is needed; individual options implemented in isolation are rarely sufficient to achieve regenerative agriculture’s ambitions.
- Discussions with advocates for farming regeneratively suggest that it can lead to an increasingly positive relationship with the soil and countryside that could prefigure a more sustainable farming future.
- One study of the available evidence suggests that initial yield reductions when transitioning (3–6 years) may reduce or even reverse over the longer term through enhanced ecosystem services.

The evidence

Assessing the implementation of regenerative agriculture principles.

Principles

Objectives	Minimise soil disturbance	Minimise bare soil	Increase on-farm diversity	Integrate livestock or approaches that deliver the same functions	Favour nature-based methods
Increase in soil organic matter	*	**	**	**	**
Improved soil structure	**	***	**	—	?
Improved nutrient availability	*	**	**	*	—
Increased biodiversity	*	**	**	*	**
Weeds, disease and pest suppression	?	*	*	**	*
Reduced environmental externalities	*	*	*	—	***
Commercial yields	?	*	*	**	?

— Negative impact * Small impact ** Medium impact *** Large impact

? Uncertain Low certainty Medium certainty High certainty

Principles

	Minimise soil disturbance	Minimise bare soil	Increase on-farm diversity	Integrate livestock or approaches that deliver the same functions	Favour nature-based methods
Indicators	Water holding capacity Bulk density Infiltration rate Organic matter Wet aggregate stability Soil organic carbon content Plant available nutrients Earthworm abundance	Percentage of soil exposure Root biomass	Plant diversity within rotation and between rotation Soil biota (micro-, meso- and macro-fauna) e.g. earthworm abundance	Soil organic matter Animal health and welfare	Nodulation of legumes Insect pest abundance
Dependent variables	Access to specialist machinery Depth, type and timing of tillage Years of minimum cultivation Waterlogging Underlying geology Soil type Annual weather variability	Agronomic decision Climate Annual weather variability Soil type Legacy of effects of previous cropping Termination of cash or cover crop timing and method	Crop mixture used Economic margins Access to specialist machinery Market needs Past management Climate	Plant species Grazing rotation Ruminants used Trade-offs with nitrogen and phosphorus On-farm infrastructure and availability of local services for integrating animals into the farming system	Integrated pest management Availability of waste-derived organic matter Plant–soil and plant–plant interactions Soil biodiversity
Socio-economic benefits	Reduced fuel costs associated with tillage	Systemic resilience to extreme weather	Diversification of income streams Potential access to subsidy payments	Diversification of income streams Increased soil fertility	Reduced purchasing of external inputs

Assessing regenerative agriculture practices and their impact on yield over time

Management practices	Short-term (1-3 years)	Medium-term (3-6 years)	Long-term (6+ years)
Organic matter (OM) amendments	neutral (improvements slow to develop), or negative where OM boosts soil borne pathogens (see below)	some positive (better soil water and temperature conditions allowing faster early season crop growth)	positive (continued improvement in soil microclimate conditions, linked to biological processes)
Reduced tillage/direct drilling	negative (benefits slow to compensate for negative effects due to poorer establishment, compaction and increased weed competition)	neutral (better rooting as soil structure improves compensates for establishment issues)	positive (better crop performance in extreme weather compared to disturbed/ploughed systems)
Winter cover cropping	positive (immediate effect on retention of nutrients over winter)	positive (continued improvement in nutrient retention/release)	positive (continued improvement in nutrient retention/release)
Management to improve soil microbial biodiversity and function (interventions as above)	negative (soil structure takes time to improve and an initial boost in OM can stimulate populations of soil borne pathogens)	positive (microbial community reasonably quick to stabilise and beneficial organisms provide functional benefits)	positive (continued improvement in soil function as soil foodwebs diversify)
Cover cropping/ continuous cover	positive (immediate impact of cover crops on subsequent crops through release of nutrients retained over winter)	positive (continuous improvement, especially where plant species are selected for allelopathic effects)	positive (maintained benefit over time)
Legumes	positive (immediate effect from BNF allowing maintained yields with less N)	positive (maintained benefit over time)	positive (maintained benefit over time)
Diverse understorey vegetation	neutral (diverse but non-competitive understorey community difficult to achieve and microbial community takes >4 yrs to respond); or negative (if non-crop plant densities are too high and compete with crop)	positive impact via above processes if non-crop plant densities can be managed at ca. 10% with a high proportion of beneficial, dicot species	positive if previous conditions met (potential benefit maintained over time)
Reduce crop protection inputs and non-target effects through threshold monitoring and forecasting	neutral (yield maintained at same levels as conventional ag but with less inputs), but greater potential risk	neutral (yield maintained but with less inputs), greater risk	neutral (yield maintained but with less inputs), greater risk
Improve crop resilience to pests and disease through biofortification	neutral (yield maintained but with less inputs)	neutral (yield maintained but with less inputs)	neutral (yield maintained but with less inputs)
Co-cropping/inter-cropping - diversity for resource use efficiency, over-yielding	potential for positive effect depending on type, location and management (immediate effect within a growing season)	positive (but improved agronomy required to compensate for potential compaction and weed burden)	positive if previous conditions met (benefit maintained)
Diverse understorey vegetation and field margins for ecosystem services (soil processes, natural enemy control of pests, pollination)	neutral for effect on crop via soil organisms (as above) since these take time to respond; some positive effect via natural IPM from mobile organisms (enhanced pollination, pest control), but mixed results for impact on yield	neutral/ small positive (improvements in soil biodiversity and aerial invert populations over time) - beneficial effects on wider system function rather than yield per se	neutral/small positive (benefits maintained provided in-field weeds are managed below competition threshold) - beneficial effects on wider system function rather than yield per se

Colours represent impact over time:
green for positive; amber for neutral; red for negative

Conclusion

“The barriers to uptake were the emotional burden of making change and bringing all parties along with you. Although there is a risk of making change, this felt like a less risky path. It is difficult to do though when some peers are not encouraging and also it involves admitting what you did before was wrong.”
Johnny Wake

As news headlines increasingly confirm, many farms in the UK face long-standing issues with their financial viability. These financial aspects intertwine with the profound relationship farmers have with their land. Despite the stresses, precariousness, long hours and dangerous working conditions, farmers persist in their commitment to the business of producing food. Morale in the sector is, however, at an all-time low according to a recent survey by the NFU.

Regenerative agriculture, with its flexible, outcome-focused principles, recognises that each farm is different. It also, critically, has created a sense of community for farmers through events like the Groundswell Festival and the emphasis on innovation and collaboration.

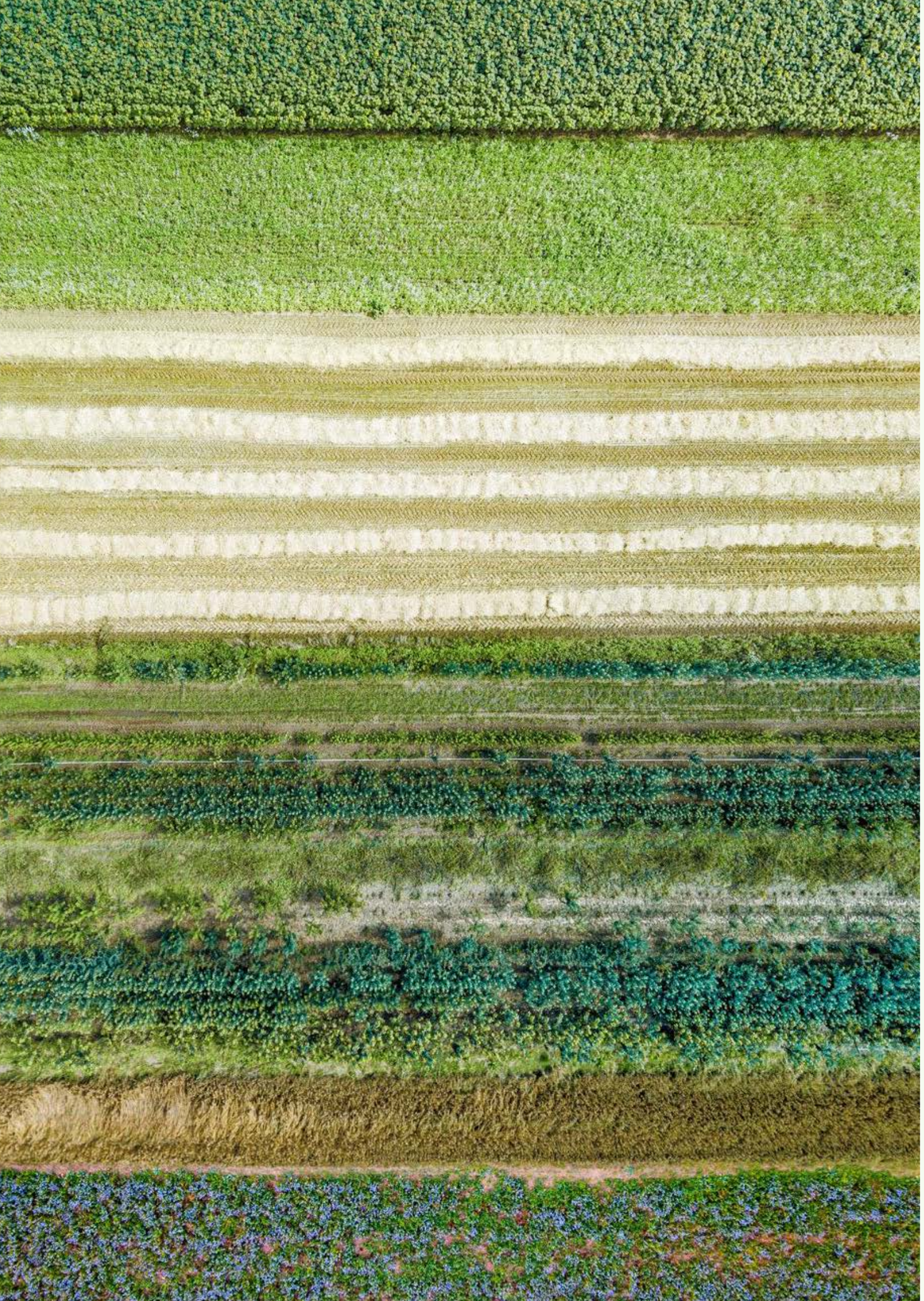
Agriculture always requires environmental interventions and this can both damage and create opportunities for restoration. But as the evidence in this report underlines, regenerative farming objectives need a layering of multiple principles to achieve. This can require a system redesign rather than a more straightforward substitution of produce or practice. When/if considering policies that could support a transition towards regenerative agriculture, decision makers in government will be more likely to achieve environment and food security objectives if this significant commitment by the farming community is understood and supported.

Due to the potential long-term improvements in the soil and ecosystem services that regenerative farming can facilitate, the farmers interviewed for the main report see regenerative approaches as a route to a more sustainable business model that could adapt to future changes, including climate change and novel invasive pests. Volatility in fertiliser prices, subsidy regimes and environmental legislation, are encouraging farmers to look for alternatives to high input farming.

The farmers interviewed cited finances and cost squeezes as one of the main reasons they had transitioned to regenerative farming. In addition to the reduction in inputs already highlighted, food produced using regenerative methods may open up new routes to market for farmers due to their enhanced environmental credentials. The increased agricultural diversity that regenerative methods foster can bolster this prospect. Nevertheless, the extent of contemporary food insecurity across the UK shows that scalability, affordability and access also remain important focal points for visions of a more ecologically sound food system.

Barriers to regenerative farming were identified by practitioners of regenerative agriculture interviewed in the report around five key themes:

1. technical knowledge and skills
2. changes in mindset
3. agricultural policy
4. finance and business structure
5. land ownership and tenancies



Recommendations

By recognising and leveraging farmers' expertise, providing comprehensive support, and maintaining sustained engagement, policy could effectively drive the transition to a more sustainable agricultural future.

Ecology and ecologists will have a vital role to play within this mission. The joint contributions of ecologists and farmers can ensure that the policy is rooted in practical, evidence-based strategies that support regenerative farming practices, including:

1. Technical knowledge & skills: support and advice to innovate

Transitioning to regenerative agriculture is a knowledge-intensive process: the current agricultural landscape is complicated and the evidence and prospects for changing farming practices depend on context and application. Ecologists and interdisciplinary research can and should inform this trajectory. Innovative practices, experimentation and technological advancements are needed to propel the regenerative agriculture movement forward. It is crucial to develop a comprehensive and forward-looking research agenda.

2. Changes in mindset: ensure farmer's voices are valued alongside science

Regenerative agriculture requires the pooling of different kinds of expertise and the development of a collaborative environment that builds strong institutions and rewards. As place-based practitioners, both farmers and ecologists can help bridge the gap between the field and the lab.

3. Agriculture policy: use regenerative agriculture principles to co-design agricultural policy

Regenerative agriculture principles should be integrated into agri-environment policy. This should be developed collaboratively with farmers to ensure positive uptake. As part of this ecologists should be open to working increasingly with farmers, policymakers and social scientists.

4. Finance and business structure: ensure the credibility, transparency and consistency of regenerative agriculture

There are currently around 600 long-term agricultural experiments of more than 20 years' duration worldwide. Such research and collaboration will play a vital role in ensuring that activities described as regenerative farming are delivering on the principles and practices discussed above. Public engagement is necessary here as, while it will be important to engage the private sector, regulators must ensure credibility, transparency and consistency across the supply chain when doing so to retain fairness to both producers and consumers.

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Read the full report:

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