Regenerative Agriculture: opportunities and reflections for industry and for embedding its principles within UK agricultural colleges

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This report provides an overview of regenerative farming practices in the USA and how these approaches may be applied to a UK agricultural education and general industry context. It details and reflects upon practices observed and discussed during a two-week tour of some of the United States' best-known and emerging regenerative farms.

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Defining Regenerative Agriculture

Regenerative agriculture is frequently mentioned these days, but what does it mean? As a relatively new movement, regenerative agriculture is still somewhat loosely defined but can be narrowed down in practical terms to the adoption of five core actions:

1. **Integrating livestock and crop production:** replicating the mutualistic relationship between plants and animals.
2. **Keeping soil covered:** using cover crops, mulch, and perennials.
3. **Minimising soil disturbance:** adopting minimal or no-till practices.
4. **Maximising crop diversity:** establishing polycultures, diverse crops, swards and agroforestry.
5. **Maintaining living roots year-round:** harnessing the soil carbon and health benefits of root exudates.

The ambition of this movement is to release farmers from their increasing dependence on expensive synthetic fertilizers and chemical inputs. By fostering a diverse ecosystem of crops and income streams—a concept often referred to as "enterprise stacking"—farmers can bolster business resilience through diversification.

Another major pillar of the regenerative philosophy is ‘holistic management’. This perspective encourages farmers and landowners to view the land as an interconnected system, considering economic, environmental, and social factors and taking all of these into account when considering farm management decisions.

In aggregate, these practices and principles aim to help us adapt to the multitudinous threats facing the agricultural sector and the world at large, specifically food security, biodiversity loss, and climate change. But how can practices like agroforestry, no-till farming, and perennials address these pressing issues? The theory is that by observing and mimicking natural processes, we can tap into the superior production potential these approaches offer, noting that wild ecosystems are immensely productive systems that have not required any human intervention at all. With this in mind, regenerative agriculture aims to exploit the production, resilience and soil health benefits of natural processes, whilst tweaking them to fit human needs. Regenerative agriculture, or ‘agroecology’, is the embodiment of this philosophy.

Post-Brexit, with the rollout of major legislative changes such as the Agriculture Act 2020 and the Environment Act 2021, there is an entirely new landscape of schemes and incentives for farmers to navigate. The most widely adopted, the Environmental Land Management Scheme (ELMs), is heavily aligned with many principles of regenerative agriculture. The benefits of regenerative practices are recognised in ELMS' principle of ‘public money for public goods’, with DEFRA stating that:

“Farmers and land managers will play an essential role in halting the decline in species, including farmland birds and insects, by 2030. The schemes will offer choice of support for more regenerative approaches to farming, and creation or restoration of habitats in appropriate areas.” – **DEFRA 2022**

Overview of Current Agricultural Teaching and Practices at FE in the UK

In the UK Further Education sector, typically catering to those aged 16-18 and older, land-based courses are divided into Agriculture, Horticulture, and Countryside Management. These areas encompass the spectrum of knowledge, skills and practices essential for successfully implementing a holistic agroecological approach, which requires understanding of the interconnected ecology of food systems and how to integrate multiple objectives in production, economics, environmental impacts, and social viability of farming and food systems (**Campbell et al 2022).**

In recent years, agricultural education has comprised of BTEC qualifications, usually spanning two years and covering broad industry knowledge and skills tailored to mainstream agricultural production. For agriculture students, these general courses introduce both livestock and crop production, with assessments through observations, written assignments and exams. This year, BTEC qualifications had been planned on being phased out in favour of more detailed, and academically challenging T-levels. Although very recently the government has decided to pause this action **(FE Week. (2024).** T-levels are significantly more complex courses that aim to develop a higher standard of knowledge and skills, with a strong emphasis on professional behaviours required in the workplace.

One issue with both BTEC and T-level courses is the relatively slow turnaround from their inception to rollout, which contrasts with the rapidly changing real-world agricultural landscape. The war in Ukraine and other global factors have drastically altered the agricultural economic landscape, causing major spikes in the prices of key inputs like fuel and fertilizer. Additionally, erratic weather patterns and the persistent threat to bee populations mean that farmers face unprecedented pressures and need to build resilience for an ever-changing world. A world that all too often changes faster than qualifications can keep up with.

While the new T-level qualifications are excellent in their detail and focus on high standards, one key issue is the complete separation of livestock and crop production. Previously, mixed farming was standard, but this new separation conflicts directly with one of the core principles of regenerative agriculture. This increased specialisation may leave learners less prepared for the polyculture required by a regenerative approach, along with the environmental, economic and food security benefits it offers.

Land-based colleges typically attract more industry-focused students than typical A-level students. Many already work on family farms, while others come from non-farming backgrounds. Despite varying degrees of experience, students are often eager to learn new industry insights and approaches. However, many arrive with ideas and principles taught by their parents and employers, who themselves are trying to keep up with the rapid pace of change in agriculture.

For much of the agricultural workforce, land-based FE colleges provide their first formal agricultural education. The principles, beliefs, and culture they adopt in their careers are significantly shaped by their experiences in these colleges. Therefore, it is imperative that the regenerative practices encouraged by the Environmental Land Management Scheme (ELMs) are incorporated into the curriculum.

Young people, who will shape the future of the sector must be inspired by the transformative potential of these practices and be exposed to how they can be implemented in practical terms. Failure to show future farmers agroecology in practice is setting them up to struggle in a world where input costs are high, and ecosystem services are increasingly strained. Furthermore, waiting to teach these approaches later on in their academic journeys, either at university or through future CPD, risks building in an engrained resistance to adopting the new approaches, with unexposed students likely to think *“this isn’t what I learnt at college’.* With this in mind, teaching prospective and student farmers the methods and mindsets of

regenerative agriculture presents a relatively easy entry point for transformation compared to changing the practices of current farmers **(Day & Cramer 2023 p.593)**.

Discussion of Potential Barriers to Teaching Regenerative Agriculture

Lack of Knowledge Amongst Lecturing Staff

Regenerative agriculture is a relatively new approach, gaining significant recognition only in the past decade. Consequently, there is a lack of knowledge and experience within the agricultural lecturing workforce. Many of these educators are accustomed to farming systems that were subsidised through EU derived basic farm payments, with less emphasis on environmental considerations and affordable inputs.

To address this knowledge gap, it is essential to adopt a hands-on approach, learning through experience and experimenting with regenerative practices on college farms. This method not only provides invaluable project-based learning opportunities for students, but also allows teaching staff to undergo their own 'apprenticeship' in regenerative agriculture, enhancing both their competence and knowledge, as well as that of their students through embedded, experiential learning year after year.

Reluctance to Adopt New Approaches on College Farms

Many college farms are longstanding institutions that have educated multiple generations and are integral to the cultural landscape of the local farming community. Previous generations often value these spaces, reflecting on their own college experiences and methods they were taught. Up until relatively recently, these former students were typically taught input-heavy, intensive approaches that regenerative agriculture now challenges, making this cultural shift difficult to accept (**Hurley et al 2024 p.17).**

Moreover, colleges face the challenge of training students to meet the needs of local farms, many of which have not yet adopted regenerative approaches. These farms may well prefer students to be taught methods that align with their own business operations as they currently stand. This creates a 'chicken and egg' scenario where the teaching of regenerative agriculture is resisted to conform with existing practices, even as these farms struggle with escalating input prices and unreliable weather patterns. This creates a vicious cycle of colleges being restricted in their ability to teach agroecological approaches, and businesses being unable to adopt agroecological approaches due to lack of upskilled workers. As one respondent to a recent survey report looking into the barriers to the uptake regenerative farming states:

> "you've got people coming out of college who are still being taught what we were taught in the 1970s…We're actually traveling in an opposite direction now." (**Hurley et al 2024 p.20).**

Curriculum Restrictions

To secure funding, colleges are required to largely adhere to prescribed curricula, even more narrowly so with the new T-level in Agriculture, Land Management, and Production. Students must choose between livestock and crop production, with mixed farming no longer being an option. This separation conflicts with the principles of regenerative agriculture and the polyculture it promotes.

However, there is potential to integrate regenerative principles into projects, teaching, and practical experiences within the student curriculum. This integration requires creative thinking and a commitment to embedding these practices, despite the constraints of the formal curriculum. The critical thinking and creativity required by this project-based approach aligns closely with the applied knowledge and behaviours expected from T-level students.

By addressing these barriers—through enhancing staff knowledge, overcoming cultural resistance, and creatively embedding regenerative practices into the curriculum—colleges can play a pivotal role in advancing the adoption of agroecological principles within the sector.

Overview of Research Project and Key Findings

This study involved a series of farm tours focusing on the farms of regenerative pioneers across the United States. Given the complexity and diversity of regenerative farms, it was felt that the best approach was to observe first hand, ask questions, discuss challenges and benefits, and identify any synergies with the challenges facing UK agriculture.

Over a two-week period, seven different farms across three states were visited. This included the farms of foundational figures in regenerative agriculture such as Joel Salatin, Gabe Brown, and Mark Shepherd, as well as those of the next generation who have built on the knowledge of these original concept farms.

Key Findings:

Reduced Inputs: it was evident from each farm visited that sustainable, productive outcomes, can be achieved with substantially fewer chemical and mechanical inputs. However, this requires a continued reliance on multi-skilled farm labour, with farmers needing to be 'jacks of all trades' rather than specialists. Historically, farmers possessed a broad range of skills, but as agriculture became more specialised, so did the associated skill sets. The real challenge lies in reversing this trend. If regenerative agriculture is to succeed on a large scale, we should train the next generation of farmers to be adaptable, curious, innovative and driven. This isn't at all to suggest that we should abandon technology, far from it. Instead, future farmers should utilise the benefits of technologies such as drones, remote sensing and minimal tillage equipment but apply their soil-saving benefits within a more complex web of agroecological knowledge. Regenerative agriculture itself should be considered a biomimetic technology in its own regard (**Gremmen 2022).**

Labour: although chemical and mechanical inputs are significantly reduced, the approaches observed do rely on labour to some extent. With labour being one of the highest costs in the farm budget, this is often cited as being a significant barrier. However, in the case of mob grazing, when compared to set stocking, the whole process is more efficient. A mob of hundreds of cattle or sheep can be moved as a single group, along with their water for the day. This, when compared to checking multiple, set-stocked fields can in fact save time and labour, with the whole process being achievable by a single person. This action also allows the farmer to see all the animals move from one paddock to the next and in doing so make any heath checks necessary, with lameness or similar issues becoming immediately apparent if present. Further to this, these principles could, if necessary be further automated, with timed-release fences already available on the market. Nevertheless, labour is a significant factor within a regenerative approach with enterprise stacking and the diversity of skills within the labour force at least partly offering potential to offset this.

Pasture Diversity: the mob grazing approach over diverse pastures seemed to result in increasing diversity over time. These pastures were structurally vibrant, alive with insects, drought-resilient, and objectively beautiful from a wildlife perspective. This is a seriously positive outcome for both soil health and biodiversity targets within the UK. If a change in grazing management can result in the sort of improvements to pasture diversity that were witnessed during this study, it would go a long way to address legitimate concerts of environmental lobbyists surrounding livestock production.

Enterprise Stacking: one of the keys to success in regenerative agriculture is the stacking of multiple enterprises rather than relying on the big payoff of one or two crops. Diversified income streams

contribute to economic resilience and sustainability, encompassing everything from wider product provision to ecotourism. This does however significantly depend on the entrepreneurial and creative thinking of the farmer in question, highlighting the importance of business and enterprise skills within the agricultural education sector.

Agroforestry: whether through the deliberate planting of agroforestry systems or the sensitive and strategic utilisation of existing woodlands for production, better use of trees within the agricultural landscape makes a great deal of sense, especially in a changing climate. It is clear from these visits that forestry and farming should not be viewed as mutually exclusive land uses. Instead, there are many synergies and strategic options for integrating both into a holistic approach.

These findings highlight the potential of regenerative agriculture to create more resilient, sustainable, and diversified farming systems. By observing these practices in action and understanding their benefits, we can inform and inspire the adoption of similar approaches in the UK, addressing the pressing challenges faced by our agricultural sector. Farmers could therefore, providing they are equipped with the relevant skills and knowledge, potentially capitalise on the significant incentives offered by the forestry commission and through SFI, allowing them to bolster both the food and timber security of the UK.

Farm Visits & Reflections

1. Ryan Erisman: Innovating on a Small Scale

The visit to Odessey Farm, located just outside Madison, Wisconsin, was a fascinating experience. This relatively small operation focuses on pigs, cattle and small-scale arable, alongside the experimental perennial crop, Kernza. The pigs are pastured from spring onwards, rotating frequently over a herbal grass ley, and are contained by a single strand of electric fencing. Their housing is custom-made and mobile, featuring simple timber frames with sheet metal and wheels for ease of movement. Water for the pigs is also mobile, provided through an IBC with nipple drinkers mounted on a basic wooden frame.

The efficiency of this system is impressive. The single strand of wire is sufficient because the pigs are conditioned before being released into the main pasture. Initially, they are placed in a steel-fenced paddock with an electric fence wire along the inside edge. This setup teaches the pigs not to cross the fence, as their instinct is to bolt when first encountering the wire, causing them to crash into the outer fence rather than escaping.

Ryan, who describes himself as a ‘junker’, acquires and adapts old agricultural machines to suit regenerative production. These vintage machines are often more appropriate for small-scale, fast rotating, and diverse cropping regimes, more reminiscent of the era from when they were designed. The farm also makes sustainable use of onsite forests, harvesting timber to improve woodland structure and for use in various farm projects, from planks and posts to tool handles and repairs. The forest also provides shade and forage for the pigs during extreme heat and autumn.

A notable feature of Ryan’s farm is the significant cultivation of Kernza, a perennial combinable grain derived from intermediate wheatgrass. Although currently in its second generation on Ryan’s farm, Kernza has progressed to the tenth generation, with much larger grain sizes. The perennial nature of Kernza makes it ideally suited to regenerative production, avoiding the need for annual soil disturbance. Ryan also described how it has the added virtue of being able to be combined for the seed, and cut for hay, as well as being grazed. Not only this, but as a perennial the roots are of significantly greater depth, improving both

drought resilience and access to beneficial minerals in deeper soil horizons. Although still in development, with grain yields said to be increasing by 9% per breeding cycle making this a serious possibility for more widescale adoption in the future **(Abram 2022).**

The cattle are grazed using a mob grazing system, alongside chickens. While effective, this practice was seen on a larger scale at other farms visited.

My visit underscored the value of agricultural education in adapting machinery and designing innovative farm infrastructure. Introducing students to emerging varieties like Kernza and integrating low-impact pasture management with woodland conservation will be crucial for future generations in adopting sustainable, lower-input agricultural methods.

One of the mobile pig shelters designed to facilitate easy movement of pigs around the pasture

Ryan buys up and modifies older machines which are typically smaller and better suited to the more diverse landscape of regenerative farms

Pigs are kept in paddocks for a few days, utilising the pasture for forage but moved on in time for them to recover quickly.

Weaners are first trained to electric fence by being kept in a steel fenced paddock initially, with a single strand of electric wire running along the inside.

2. Mark Shepherd: Permaculture and Productive Ecosystems

Mark Shepherd's New Forest Farm stands out as one of the most unconventional, yet highly productive, farms visited during the tour. Developed on previously conventional farmland with some steep topography, the farm is a premier example of permaculture—a self-sustaining agricultural ecosystem.

The site features a diverse array of tree species, with hazelnut and sweet chestnut trees being the primary crops. These trees are planted along the land's contours to maximise water interception. Combined with strategically placed ponds and swales, this setup ensures efficient water management through passive use of water as it slowly runs off the land via 'keyline' irrigation. The site overall is characterised by bands of contour planted trees, laid out in parallel rows, with the land in between rows being reserved for perennial crops, occasional annual crops and diverse pasture.

In addition to the dominant tree crops, the food forest includes apple trees, mulberries, Nanking cherry *Prunus tomentosa*, and Korean pine *Pinus koraiensis* for its nuts. Beneath the canopy, crops like asparagus are grown, as well as pasture for feeding cattle, pigs, and chickens in separate sub-enterprises. In shaded areas beneath mature trees, mushrooms are cultivated on stacks of organized deadwood, previously inoculated with the desired mushroom varieties.

Mark describes his management approach as "sheer, total, utter neglect" which focuses on minimal intervention **(Shephard 2019).** While livestock welfare is maintained to high standards, the term refers to allowing trees and crops to thrive without constant management. Species which do not thrive are considered unsuitable for the site, while those that perform well are retained, their seeds collected, and their progeny integrated back into the system. This method of developing site-specific landraces reduces labour costs, boosts productivity, and enhances the system's genetic and overall resilience

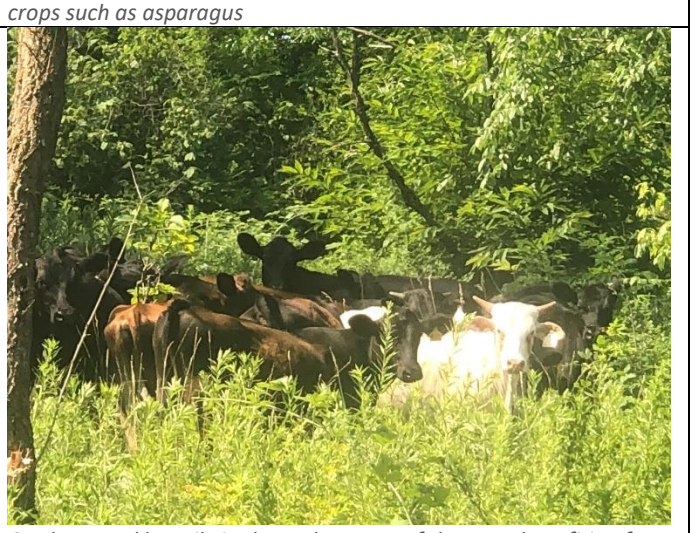
To conventional agriculturalists, this farm would be a significant departure from the norm, but the laid-back approach, in the long run means effort is not wasted trying to force unsuitable plants to thrive, and encourages only those species best adapted to the system to prevail. This approach makes sense with the perennial crops focused on in this setting as, once trees are established, the system needs comparatively little maintenance, and simply provides resources passively. The diverse microclimate within this 'food forest' also lends itself to a more diverse range of crops. The aforementioned mushrooms, for instance, thrive in the shade created by the overlying trees, an example of intercropping, where crop improves conditions for the other, effectively allowing more to be produced from the same area of land, a metric that considers the yield of a polyculture and calculates the amount of land that would be required if the crops were grown separately (**Wilson & Lovell 2016 p.7).**

This model represents a significant departure from conventional UK agriculture but offers potential for hill farming areas, particularly those worst affected by the loss of basic farm payments. The topographically arranged planting could also address issues such as flooding, nutrient runoff, and soil erosion, contributing to the UK's ambitious tree planting goals. The model potentially allows farmers to continue food production with fewer inputs. Overall, agroforestry of this type could be a productive alternative to the current trend of blanket tree planting on unprofitable hill farms, allowing producers to keep producing with alongside delivering multiple environmental, ecological, and socio-economic benefits, with the potential for land uses like this contributing towards least nine of the 17 UN Sustainable development goals (**Zomer et al 2022).**

Hazel nuts and chestnuts were the two primary crops of the 'food forest'.

Some of the land between tree rows was put down to perennial crops such as asparagus

Rides were cut into some suctions to allow easy access through the woods and make daily livestock checks practical



Cattle grazed happily in the understorey of the trees benefiting from diverse forage and ample shade

Strategicly placed ponds were located at the highest points of the property, storing water for gradual passive irrigation through the keyline system. Full of invertebrate and amphibian life

Cut logs were carefully laid out in large areas across the understorey of the wooded areas. Innoculated with desireable species mycellium such as oyster and shitake.

Mike Sands: Ethical Meat Production through Sustainable Practices and Self-Service Innovation

Mike Sands' Bean Hollow grass-fed farm specialises in grass-fed meat, catering to consumer demand for locally-sourced, ethically-raised products. All produce is sold through a self-service farm shop, reducing costs with an unstaffed setup consisting of labelled freezers, a price list, and an automated contactless card payment system. Meat is raised and processed entirely on the farm, with poultry slaughtered and processed onsite.

The farm practices daily pasture rotation for cattle (Angus & Red Devon Crosses) and sheep (Dorper & Katahdin Hair sheep), combining them into a single group, or 'flerd' to maximise grazing benefits from mixed species. This approach not only enhances pasture utilisation but also helps control parasites and eliminates the need for fertilisers, insecticides, wormers, and other chemical treatments. As a result, the farm enjoys a premium for its chemical-free products. Multi-species grazing like this is an exceptionally efficient way of getting the most out of diverse pastures, with adding sheep to a cattle herd you get 20-25% greater productivity and carrying capacity over cattle alone and 8-9% greater productivity over sheep alone (**Rinehart 2018).**

The only chemicals used are for controlling invasive plant species, which benefits both the farm and the local environment. Mike and his team ensure that livestock stay away from onsite streams, mitigating erosion and runoff through their grazing management practices. This environmental stewardship not only reduces input costs and management time but also demonstrates to customers the benefits of regenerative agriculture in supporting ecological conservation and enhancing local watersheds.

Mike grazed cattle together with sheep in a single 'flerd' which were moved as a united mob around the farm.

Costs were kept down by operating an innovative self-service, freezer-based farm shop

The pigs raised in the woodlands were utilised to deliberately improve structural diversity and health of the woodland shrub layer, and moved on quickly enough to avoid excessive disturbance.

The mob grazed flerd moved through areas quickly leaving some grass trampled and the rest grazed lightly enough to allow for the development of deep drought-resistant root systems.

Jordan Greene: Refining woodland raised pig production at J & L Greene Farm

Jordan Greene and his wife Laura run J & L Greene Farm in Edinburg, Virginia. Jordan's journey into regenerative agriculture began as an intern under Joel Salatin, and his work today exemplifies the forward-thinking approaches of the next generation of regenerative farmers in America.

Jordan's woodland-raised pig production is a standout example of this innovation. Here's how it works:

- **Woodland Management**: each year, a couple of acres of the farm's woodlands are thinned to enhance forest health, retaining large black walnut, oak, and hickory trees whenever possible.
- **Paddock System**: pigs are introduced to the woodlands and confined in small, electrically-fenced paddocks, initially accommodating about 50 weaner pigs per half-acre. This size varies with ground vegetation and the pigs' size.
- **Nutrient Cycling**: pigs are kept in a paddock for 3-5 days before being moved. On the penultimate day, barley seed is scattered over the land to absorb any excess phosphorus from the pigs' dung and convert it into a living forage crop, which the pigs will later consume when they return to the area.
- **Rest and Regrowth**: paddocks are allowed to rest to let the vegetation fully re-establish before pigs return.
- **Forage and by-products**: the oak, hickory, and black walnut trees provide additional food for the pigs once the nuts fall. Jordan also taps the black walnut trees for syrup, which he sells at a premium. Thinned timber is also sold, both for firewood and higher value lumber.

- **Next to no permanent infrastructure**: the simple, modular infrastructure and electric fencing is mobile and low cost. As a tenant farmer, Jordan has invested very little in expensive infrastructure and could move his operation to another site relatively easily if ever required.

The phased thinning of trees and the pigs' management of undergrowth allows more light to reach the woodland floor. This, in turn, enables sufficient grass and herb growth for Jordan to graze cattle in the woods during the hotter months, moving them frequently to prevent damage to the woodland floor. The result is a highly productive woodland ecosystem with productive soils that avoid eutrophication. Disused pigs' wallows which were found throughout the woodland, had since filled with clear water and were populated by bullfrogs and invertebrates. This demonstrates the potential of this approach for delivering ecologically positive 'side effects' through the farming process.

This approach illustrates that agricultural production and woodland management for timber and wildlife can coexist. It provides landowners with an option to achieve food and timber security while maintaining high welfare standards for pork production. By mimicking the natural disturbances once created by wild boar in Europe, Jordan's method harnesses the inherent productivity of woodland ecosystems.

Jordan's chicken operation is equally innovative. He uses a mobile chicken coop, created from an old carport frame and modified with metal skids and predator-proofing. Pulled forward daily by a tractor, this cost-effective coop provides fresh pasture for the poultry to forage.

The idea of this is that the chickens enrich the soil with their manure and follow the cattle herd to break apart cow pats. Further to this, it was suggested that this could help in controlling fly larvae, reducing fly stress for the cattle and providing additional protein for the chickens. Although this makes sense in its concept, it's hard to say how effective this was. There didn't appear to be many flies bothering the cows but it's hard to say that the chickens were the cause. With this in mind a study of a similar approach by Phillips et al was not able to demonstrate efficacy (**Phillips et al 2020 p.1).**

The coop's design allows for quick relocation—within 10 minutes—which makes it quick and easy to manage the chickens each day. The feed hoppers and water supply are also mobile with the unit.

Another notable feature of Jordan's farm is the use of guardian dogs to deter predators. In Virginia, the threat to chickens includes coyotes, raccoons, bobcats and black bears. Jordan employs Hungarian Kuvasz guardian dogs, which are well-suited for protecting livestock around the clock. This chemical-free approach to predator control keeps unwanted animals at bay without the need for extensive fencing or lethal measures, and is proven to significantly reduce livestock losses to predation (**Jenkins & Noad 2003).**

Pigs are kept in paddocks long enough to clear the previously sown barley and moved soon enough to prevent damage to the soil

The phased disturbance and rest from the pigs noticeably contributed to the structural diversity of the woodland floor and shrub layers.

A home-made, tractor-pulled broiler shed, gave chickens access to fresh pasture, spreading fertility as they go

Poultry slaughter and processing was carried out onsite with produce taken directly to the farm shop

On site farm shop makes its sales through promoting its methods and welfare

Everything is composted, even fallen stock! Material is incorporated with wood chip and stacked to get sufficient heat for rapid decomposition.

Joel Salatin: The Pioneer of Regenerative Agriculture at Polyface Farm

Polyface Farm, operated by Joel Salatin and his family, is a pioneer in regenerative agriculture and an exemplar of the concept. With a dedicated team of volunteers and interns, the farm demonstrates the principles of 'enterprise stacking' through a diverse range of products and practices.

The onsite farm shop offers everything from meat and eggs to cattle skin rugs and farm-produced cosmetics, alongside a selection of books on regenerative agriculture authored by Joel Salatin. What stands out about the shop is the range of products created by former interns. These interns, who receive comprehensive training on the farm, are encouraged to explore all aspects of farm operation, from building chicken coops to milling timber and processing livestock. This hands-on experience equips them to manage their own regenerative farms, contributing innovations such as tallow-based cosmetics, jewellery, and honey to the farm shop.

Polyface Farm is renowned for its array of innovations, including:

- **Mobile Turkey House – Gobbledy-Go**
- **Mobile Hen House for Laying Birds – Egg Mobile**
- **Mobile Livestock Shade – Shade Mobile**

These structures, designed for various animals from sheep to ducks to rabbits, embody the farm's ethos of being "Mobile, Modular, and Management Intensive."

- **Mobile**: all infrastructure is towable or collapsible, allowing farmers to take their investments with them if they change locations.
- **Modular**: the modular approach allows farmers to start on a small scale and expand as they find success, reducing the risk associated with large initial investments.
- **Management Intensive**: the designs are intended for daily movement, which prevents overgrazing, distributes manure evenly, minimises parasite exposure and promotes soil organic matter build up.

Polyface Farm manages the entire lifecycle of animals onsite, from hatching chicks to composting inedible parts and deadstock, including cattle. While this comprehensive approach is ecologically sound, it is less common in the UK due to biosecurity concerns and higher population density. Nonetheless, it highlights a gap in the UK's approach to livestock and nutrient management.

The key takeaway from visiting Polyface Farm is the potential for UK land-based colleges to adopt a similarly interconnected approach. By exposing agriculture students to the entire spectrum of land management—forestry, timber processing, and infrastructure building—colleges could foster a more integrated understanding of farming, forestry, and conservation. This holistic educational model promises to enhance cross-sector integration and improve learning outcomes.

The other strength of the approach at Polyface is that of the mobile and modular infrastructure. The modular approach allows farmers to construct farm infrastructure gradually and scale up as their business grows, lessening risk. Furthermore the mobile nature of this infrastructure lends itself to tenant farmers who may be reluctant to invest in static infrastructure which they would be at risk of losing if they moved on (**Hurley et al 2024 P.7)**. This mobile and modular approach therefore could address some concerns amongst farmers who may be wary of investing in a change to regenerative agriculture.

The "Gobbledy-go" is a mobile turkey shade and shelter, designed around the principle of continuous movement

The 'shade mobile' is a costs effective way of providing shade to cattle as they are moved daily around pastures

Mobile laying shed, built from timber cut and milled on site

Original polyface design for small scale mobile broiler houses, moved daily.

Utilising an onsite sawmill cost-effectively opens up farm woodlands to sustainable use, significantly saving on bought materials.

Enterprise stacking seems to be a key part of the resilience of regenerative agriculture, profiting from as many products and by-products as possible

Dragonfly Farm: Embracing Ecotourism in Regenerative Agriculture

Dragonfly Farm, operated by Bruce and Katherine Johnson, is a compelling example of regenerative agriculture on a large scale. Spanning over 800 acres, their farm blends woodland and pasture into a patchwork of diverse ecosystems. The Johnsons' approach highlights the aesthetic and ecological benefits of regenerative practices.

Key Features of Dragonfly Farm:

- **Diverse Grasslands**: the Johnsons practice holistic mob grazing with cattle and sheep across exceptionally diverse grasslands. These pastures, once dedicated to corn and soybean production, have been transformed into vibrant landscapes featuring an impressive array of herbs and wildflowers.
- **Aesthetic and Productive Benefits**: the resulting landscape is not only productive but also visually stunning, which allows Dragonfly Farms to offer horseback tours. This additional enterprise leverages the farm's attractive habitats, a stark contrast to the less appealing monocultures of soybeans and corn. This was a prime example of how a regenerative approach can open up opportunities for additional farm income through so-called 'agroecotourism' (**Cavaliere 2010 p.33).**
- **Holistic Grazing Approach**: by using a holistic mob grazing strategy, the Johnsons ensure that no single plant species dominates. This approach involves long rest periods and intensive disturbance by large herds of cattle, fostering a diverse range of plant species. The diversity in pastures rivals that of many wildflower meadows, supporting a wide variety of insects and wildlife.
- **Complex Pasture Structure**: the farm's diverse pasture includes species adapted to different conditions. Cooler-climate species thrive in the 'understorey', while heat-tolerant grasses dominate in the summer. This layered structure provides excellent vegetative cover throughout the growing season and offers cattle a varied and nutrient-dense diet, enhancing the quality of the beef.

Significant structural and species diversity (including insects) was evident throughout the pastures that were subjected to intense grazing and long rest periods

The attractive, nature rich and diverse landscapes that are created through a regenerative approach lend themselves to ecotourism. At Dragonfly farm, horseback farm tours help contribute to income. It would be hard to sell such an experience through a monoculture landscape.

Cattle had access to trees in areas where planned summer grazing took place providing natural shade

The pasture utilisation and structure diversity benefits were exploited through use of mixed livestock species

7. Brown's Ranch: Large-Scale Regenerative Agriculture

Brown's Ranch, managed by Gabe Brown's son, represents regenerative agriculture on a grand scale. Gabe Brown, a pioneer in the field, gained widespread recognition through his book *Dirt to Soil*, which brought regenerative practices to the attention of mainstream producers.

Key Features of Brown's Ranch:

- **Scale and Diversity**: spanning over 5000 acres, Brown's Ranch has transitioned from traditional corn and soy monocultures to a diverse operation that includes grass-fed cattle, sheep, pastured chickens and pigs, vegetables, cereals, and a substantial honey production side-line.
- **Regenerative Principles at Scale**: the ranch exemplifies regenerative agriculture principles on a massive scale. Cattle are moved daily across extensive pastures, supported by a convoy of mobile chicken coops. Hungarian Kuvasz dogs guard the livestock, ensuring protection from predators.
- **Diverse Cover Crops**: one of the most notable features of Brown's Ranch is its use of highly diverse cover crops. These cover crops are either grazed by cattle or cut and baled for winter use. The diversity of cover crops contributes to soil health by providing a wide range of root exudates, which

enrich the soil with sugar-rich compounds. This diversity in turn supports a complex microbial ecosystem, including bacteria, protists, and fungi, enhancing soil health and carbon storage.

- **Soil Health and Carbon Storage**: the extensive use of cover crops and diverse pastures at Brown's Ranch promotes soil health and carbon sequestration. The varied root systems and organic matter contribute to improved soil structure, nutrient availability, and overall ecosystem resilience.

In summary, both Dragonfly Farms and Brown's Ranch showcase the effectiveness of regenerative agriculture in enhancing biodiversity, soil health, and productivity. Dragonfly Farms exemplifies how diverse grazing systems and aesthetic value can complement each other, while Brown's Ranch demonstrates the scalability of regenerative practices and their potential to transform large-scale agricultural systems. Both farms underscore the importance of diversity and holistic management in achieving sustainable and resilient agricultural landscapes.

Honey was another product contributing to the farms overall income

Benefits were evident in the healthy structure of the soil

Species and structural diversity was restored in vast areas of native pasture on Brown's ranch through the mob grazing methodology

The efficiency of mob grazing is that it is a similar amount of work if you are moving 20 animals or 200

The mobile poultry model on brown's ranch was similar to the rest but on a much greater scale

Pastured pork was also among the produce on offer, their rooting adding further to the farms pasture diversity and produce ranges.

Sunflowers direct drilled into the stubble of a previous crop

A diverse cover crop of triticale, hairy vetch and rye which has multiple uses; grazed, cut for winter feed or crimp-rolled, before being drilled with a cash crop

Conclusions & Opportunities for UK Agricultural Education and Beyond

The journey through regenerative farms in the USA illuminated key insights and opportunities for the future of agricultural education in the UK. The innovative spirit, multidisciplinary approach, and diverse practices observed provide a roadmap for evolving agricultural education and practice. This section summarises how these observations could potentially be harnessed to enrich UK agricultural teaching, address current challenges, and inspire a new generation of farmers. By integrating these lessons, we can foster a holistic approach to farming, enhance environmental stewardship, and invigorate rural communities, ultimately shaping a more resilient and sustainable agricultural future.

The following are a summary of key opportunities for the UK agricultural sector alongside insights of value for our current and future agricultural and land-based students.

Embracing Innovation: the US farm tours highlighted a vibrant spirit of innovation among regenerative farmers, who creatively adapt and refine methods to fit their unique contexts. This pioneering mindset, and willingness to 'have a go' offers a valuable lesson for UK agricultural education, encouraging a culture of curiosity and hands-on, experiential problem-solving among future farmers.

Fostering Multi-Disciplinary Expertise: regenerative agriculture thrives on integrating diverse disciplines. To replicate this success in the UK, educational programs should bridge gaps between agricultural, forestry,

horticultural, and business studies. A holistic approach will better prepare students for the multifaceted nature of regenerative farming.

Maximising Enterprise Stacking: the concept of enterprise stacking—combining diverse economic activities and experiences—proves crucial for the resilience of regenerative farms. This model not only diversifies income streams but also enhances rural tourism opportunities through 'agroecotourism', offering a path to rejuvenate declining rural communities.

Addressing Flooding and Upland Farming Challenges: with increased flood risks and struggling upland farmers, the regenerative practices observed could significantly impact UK flood management strategies. Strategic tree planting and improved soil management offer promising solutions for both flood risk reduction and upland farm viability.

Biodiversity Net Gain: The changes to UK planning rules as brought forward by the Environment Act 2021 require developments to result in a 10% biodiversity net gain **(UK Gov 2024).** This has led to many farmers considering turning over their land for the creation of habitat for a 30 year agreement. This has been considered controversial to many who see this as a threat to food security in the long term. The nature rich farms visited during this tour could provide a model for how BNG could be applied alongside food production. This is especially the case for the model observed at Mark Shepherd's 'New Forest Farm', potentially delivering much needed biodiversity alongside climate resilient, low maintenance perennial food production.

Revitalising Regenerative Forestry: the underutilised farm woodlands in the UK could benefit from the regenerative practices observed abroad. By viewing woodlands as integral to the farming system, rather than side-lining them for isolated purposes or ignoring them altogether, we can enhance timber management, forage availability, and biodiversity while supporting climate resilience.

Broadening Agricultural Education: the diverse skills required for regenerative agriculture highlight the need for a comprehensive educational approach. FE colleges should offer a broad agricultural curriculum that introduces students to regenerative methods early on, integrating forestry, horticulture, and business education. This would be best achieved through using college farms as 'field labs', where the biomimetic technology of regenerative agriculture can be tried, tested, refined and normalised within the culture of our existing and future farmers (**Hurley et al 2024).**

Attracting Young Talent: the dynamic and varied nature of regenerative farming could invigorate interest in agriculture among young people. By showcasing regenerative farming as a career that offers innovation, environmental impact, and diverse opportunities, we can attract a new generation to the field.

Shaping a Positive Agricultural Narrative: regenerative agriculture has the potential to redefine the image of farming in the UK, presenting it as a force for positive environmental stewardship and high-quality food production. This shift in perception can attract more young people and support the long-term sustainability of the industry.

Resilient farm economics: Ultimately farms are food production businesses, and like all businesses they need to make a profit. The regenerative approaches witnessed during this study demonstrated this, and their diverse land uses significantly added to their economic potential rather than detracting from it. Farms must produce food, and viable amounts of it, but to leave other forms of income off the table fails to realise the benefits of a regenerative approach.

Farming regeneratively and incorporating farm woodlands into a productive 'whole' produces landscapes and wildlife abundance which, although intrinsically valuable, also produces opportunities for significant

agroecotourism income. The potential for this should be considered in light of the relative value of the UK tourism economy (9.5% GDP) or 1 in 9 of all jobs **(WTTC 2023)** when compared to agriculture at just 0.6% **(Defra 2023)**. By farming regeneratively and creating the beautiful and vibrant habitats on farms that tourists want to visit, alongside the nutrient dense, local produce many tourists hope to try, farmers could make this significant part of the UK economy work for them. Ultimately, this could allow agroecotourism to provide an alternative income 'subsidy' to their primary food production enterprises.

As previously mentioned, taking an agroecological approach to land management aligns well with the financial incentives offered by the new long-term 'biodiversity net gain' payment agreements available to landowners. It's worth noting that the benefits of this can also be layered on top of the income from rural tourism, providing both environmental and local economic resilience as well as contributing to the social resilience rural communities.

An alternative approach would be that of monoculture, and high-density, single-species factory farms. Although the economies of scale can result in a low unit cost, they are vulnerable to unforeseen crises. If the past few years has taught us anything, the risk of disease outbreak and spiking energy costs is ever present and is something that such enterprises are highly vulnerable to. Influenza outbreaks for example, such avian flu in 2003 and the swine flu epidemic in 2009 (and more recently in Nigeria), are a common occurrence on intensive animal farms **(Dhont et al 2021).** Given the level of investment required on these farms, and the vulnerabilities present, could the spread risk of regenerative farming be a smarter way forward?

Although bioenergy generation can be one form of enterprise which stacks with factory farming, again its viability rises with the size of the farm, and thus requires greater sunk cost and risk. This high-cost approach is also unlikely to be accessible to small scale farmers, especially those just starting out. Further to this, it goes without saying that other income opportunities such as agroecotourism are unlikely to have much appeal in this setting, and therefore potentially less economic spill over will be made available to local communities.

In conclusion, it seems that the substantial reduction in synthetic inputs, opportunities to stack enterprises and the environmental resiliance benefits of regenerative agriculture itself, are ideally suited to the economy of the 21st century. With so much uncertainty in the years ahead, can farmers really afford not embrace regenerative agriculture?

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