

# A Just Transition in Agriculture

GEF Project Just Transition  
Anne Chapman



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Green House Think Tank aims to lead the development of green thinking in the UK through stimulating debate and discussion to challenge the ideas that have created the world we live in now and offer positive alternatives.

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## About the Author

Anne Chapman is co-chair of Green House Think Tank. She worked as an environmental consultant, following a degree in Biochemistry at Oxford University and a Masters in Environmental Science at Manchester University. She did a Masters Degree then PhD in Environmental Philosophy at Lancaster University. Her PhD, on the regulation of synthetic chemicals, was published in 2007 by Earthscan, as *Democratizing Technology; Risk, Responsibility and the Regulation of Chemicals*. For Green House she has written about Greens and Science, housing, dealing with extreme weather events, climate jobs and community energy in the UK. She grew up in a rural part of south Shropshire and now is co-owner of a small area of partly bracken-covered hillside in South Cumbria.

## About the project

This paper is part of the Green European Foundation's Just Transition transnational project. The project looks into the question of transforming from an extractive to a regenerative economy in a just and equitable way in order to find the necessary support among the population. The project is focused on collecting and sharing insights on the development of future-proof politics and policies, developed in a sensitive way that keeps in mind local specificities. The project is, on behalf of GEF, coordinated by OIKOS (Belgium), who authored a framing paper, *Climate, Jobs and Justice for a green and socially just transition*, published in December 2020. The project partners are Green House Think Tank (UK), Institute for Political Ecology (Croatia); Sunrise (North-Macedonia), Transición Verde (Spain), Federation of Young European Greens (FYEG) and Networked (Serbia). In 2020 these partners carried out various activities in their countries to increase awareness of the importance of a Just Transition. In 2021 they will collaborate on the production of a book showcasing the main challenges and opportunities around Just Transition, to be published in autumn 2021. This publication will feed into the broader scope of the project.

## Acknowledgements

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# Summary

In the last seventy years agriculture in Europe has changed beyond recognition. Farms have mechanised and become more specialised. They use an arsenal of synthetic chemicals which enable them to grow and produce new, more productive but less resilient breeds of plants and animals. This industrialised agriculture, aimed at maximising output, has succeeded in feeding the European population after the devastation of the Second World War. It has allowed big farms, and large companies in other parts of the food chain, to prosper. From all other points of view it has been a disaster: it has degraded soils; increased flood risks; polluted water and air; led to the loss of wildlife, and the decline of agricultural communities. Animals are kept in cramped, prison-like conditions. Many jobs in farming have been lost and farms have gone out of business, despite massive public subsidies. Too many of us know too little about how our food is produced and the land that produces it. While most (but not all) of us have plenty of food, too many do not have healthy diets and what we eat is contaminated by pesticides.

Farming needs to change if we are going to address the twin crises we are facing of climate change and biodiversity loss. These crises need to be tackled together. Debates about the future of agriculture are often framed as whether to ‘spare’ or ‘share’: to produce the food we need intensively on as small an amount of land as possible, so that other land can be left for nature; or to farm more land in a less intensive fashion so allowing wildlife to share it with us. This seems to me to be a false choice, primarily because modern intensive farming is not sustainable in terms of the energy and other resources it uses and its impact on air and water quality so its continuation is not a long term option.

Instead farming needs to be done in a way that rebuilds the health of the soil to wean it off its dependency on synthetic inputs. These regenerative farming practices are good for wildlife as well as farm profits and are increasingly being taken up by all types of farmers. Regenerative agriculture

involves limiting disturbance of the soil by reducing ploughing and synthetic inputs, keeping the soil covered as much as possible with crop residues and through growing cover crops, and increasing diversity – of plants, animals and enterprises. Most importantly, regenerative agriculture involves a change in mindset, from trying to maximise yield to maximising profit per hectare through minimising inputs, improving soil health and developing a diversity of enterprises on the same land. It requires an approach of continual experimentation and learning. Such diverse agricultural systems are more capable of providing varied, interesting, knowledge-based, year round employment – more and better work – than industrialised farming.

In another approach, that I have called ‘farming for nature’, the main aim is to restore particular habitats, species or natural processes; with food as a by-product. The cessation of farming on marginal land has not always resulted in gains for biodiversity. Grasslands in particular can become less diverse, taken over by invasive species (such as bracken in the UK) when grazing is stopped. Well-managed grazing by the right sort of herbivores (often hardy, native breed cattle) can restore biodiverse habitats, sequester carbon and help prevent flooding as well as retaining jobs in farming.

The culture of agricultural communities is very different from those of post-industrial areas, but like the latter, they have suffered from substantial declines in jobs and losses of what formerly held them together. There is a danger that, feeling ignored by the prosperous cities, those in rural communities who have lost out turn to political extremists who seem at least to give them someone to blame for their plight, in the way that many in rural America turned to Trump in 2016. The decimation of agricultural communities is therefore something that we should all be concerned about. Agriculture needs a just transition as much as coal mining communities do, but whereas there is no future for coal mines in a zero-carbon world, there has to be a future for agriculture.

***The last forty years on the land were revolutionary and disrupted all that had gone before for thousands of years – a radical and ill thought-through experiment that was conducted in our fields.***

James Rebanks, 2020 p.6

## 1. Why agriculture matters

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Agriculture clearly matters because it provides us with most of the food we eat. It takes up nearly 40% of the EU land area and about two thirds of the land in Britain and Ireland,<sup>1</sup> and how farming is done determines what other species can survive on that land. It is also of critical importance to the rural economy and communities. Farming does not just provide an income but an identity: the work of farming brings people together through shared interests in the crops they grow, the breeds of livestock they keep and the work of managing the land.

There is a tendency to see the countryside as an unchanging place. ‘Modernity’ is located in urban areas with their fast pace of life, from which urban dwellers escape to countryside retreats. But the scale of changes to the countryside in the last fifty years has been vast. The push towards more ‘efficient’ methods of production has resulted in larger, more simplified and more specialised agricultural enterprises that use bigger machines, more fertilisers and pesticides and faster growing varieties of crops and breeds of livestock. The bigger, faster growing breeds, kept in ever larger numbers, are more susceptible to disease so require ever more medication to keep them alive.

The removal of diversity from farm enterprises has resulted in the loss of biodiversity from the land; a disaster for wildlife. Soils have been rendered lifeless and dependent on continual inputs of chemical fertilisers to produce a crop. Modern farming has resulted in agriculture being a major contributor to green house gas emissions. Small, mixed farms have gone out of business, their land taken over by larger farms, or in some regions, abandoned. The number of people employed in farming has drastically declined and the people that are employed, for example in seasonal fruit and vegetable picking, as well as on mega livestock farms, are often migrant labour. This has fractured and hollowed out rural communities: in some

places the farm workers that used to live in villages have been replaced by wealthy commuters or retirees, or properties have become holiday homes, while other regions have been depopulated.

This modern, industrialised form of agriculture is most advanced in the USA. There 100,000 farmers went out of business between 2011 and 2018 and rural communities are falling apart, with a loss of jobs, closed businesses and empty properties.<sup>2</sup> These communities have been the base of the support for Trump: his demonization of the ‘liberal urban elite’ and immigrants, though not providing solutions, gives struggling agricultural communities someone to blame. Perhaps this makes some sort of sense when you see apparently thriving cities ignoring the catastrophic loss of family farms and migrant workers doing most of the work that is left. In Europe it was rural areas that provided support for fascist parties in the 1930s and, according to Martin Conway, the common agricultural policy was part of the project of building democracy in Western Europe after the war (Conway, 2020). It protected farmers from the swings in global prices and provided them with stability so they would not vote for the hard right and fascists. To preserve democracy we need to pay attention to what is happening to farming.

The growing consciousness of the destructive effects of modern farming has resulted in what the Cumbrian farmer James Rebanks has called a culture war. On one side are those who see the cheap food that modern farming has made possible and think that farming should make use of all available technologies to become ever more productive and efficient. On the other are those who think that farming is trashing the earth and who, in Rebanks’ view, don’t understand the reality of what has to be done to produce food – which is that killing is always involved, whatever you eat (Rebanks, 2020, p.158). Farmers feel besieged by the criticisms levelled at them, countering

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<sup>1</sup> In 2016 – [https://ec.europa.eu/eurostat/statistics-explained/index.php/Farms\\_and\\_farmland\\_in\\_the\\_European\\_Union\\_-\\_statistics](https://ec.europa.eu/eurostat/statistics-explained/index.php/Farms_and_farmland_in_the_European_Union_-_statistics)

<sup>2</sup> <https://time.com/5736789/small-american-farmers-debt-crisis-extinction>



that they have just been doing what government policy and ‘consumers’ (via the supermarkets) have been asking them to do: be more productive and produce cheap food. But many farmers are now trying to change how they farm so they cause less damage to nature: to farm in a ‘nature friendly’ way while still producing food. Those of us who are not farmers need to learn more about farming because we eat its products and support it with our taxes; we too are implicated in the destruction modern farming has caused and have a role to play in transforming it.

That a transition to zero carbon requires significant changes to agriculture is clear. It is also clear that agriculture needs to change if we are going to halt the destruction of biodiversity that modern farming has caused. These two crises, of climate and biodiversity need to be addressed together, not separately. The economic crisis in agriculture, with farmers trapped between the rising costs of their inputs and falling prices for their outputs also

calls for change. The pay and conditions of farm workers, particular migrant labour, clearly needs addressing, but this cannot be done effectively without changes to farming itself, and the wider food system it is part of. A just transition has to involve farmers and others who work on the land in working out what that change should be, so in this report I examine two ways forward that have come from farmers and landowners: firstly, regenerative agriculture, and secondly what I am calling ‘farming for nature’ – where food production is second place to managing the land to maintain particularly valuable habitats or restore natural processes. These are not mutually exclusive practices, rather perhaps they are different ways of conceptualising what is being done. Both may take place on the same farm, or the same field. I discuss two key issues in the future of farming: the role of livestock, and the extent to which we should seek to maximise food production. However, first I outline the key aspects of the intensive farming experiment, its results and causes.

## 2. The intensive farming experiment

There are four aspects to the changes in farming that have taken place over the past few decades: mechanisation, new synthetic chemicals, new breeds of animals and plants, and changes to farming practices. These have worked together to bring about the enormous changes we have seen. Each is discussed below, followed by what the results of these changes have been on greenhouse gas emissions, wildlife and people, and finally a discussion of why these changes have come about.

### Mechanisation

Eighty years ago most cultivation would have been done with a horse-drawn plough. The ploughman walked behind the horse, close to the land and able to observe it. Tractors came to dominate from the late 1940s and ‘50s. Whereas previously farmers had grown the feed needed for their horses, they now had to buy in the fuel needed for tractors, making them less self-sufficient, but freeing up land for food production. Tractors lifted the farmer above the ground but, initially, the driver was still exposed to the elements. However, over the past five decades tractors and other machinery

have got bigger and faster: tractors were around 50-100 horsepower in the 1970s<sup>3</sup> but can be over 300 horse power today<sup>4</sup> and those driving them now sit in enclosed cabs cut off from the land they are cultivating. It is now possible, with the assistance of headlights and a satellite navigation system to cultivate a field in the middle of the night while watching YouTube videos. James Rebanks describes how, when rolling a field forty years ago, his grandfather stopped the tractor, got down and retrieved a nest of Curlew’s eggs, which he later replaced (Rebanks, 2020, p. 29). There is little chance of a modern tractor driver even seeing such a nest let alone stopping to rescue it. Bigger machines compact the soil, need bigger gate posts and bigger fields without the hedgerows and other nooks and crannies where wildlife might lurk. And smaller farmers can’t afford them: many use agricultural contractors to harvest their crops rather than doing it themselves. Mechanisation has vastly reduced the number of people working on farms and soon may remove people from the fields entirely: the Hands Free Farm project is trialling the use of driverless tractors with drones to assess field conditions, so no one needs to go to the land at all.<sup>5</sup>

<sup>3</sup> <https://www.fwi.co.uk/machinery/farmers-tractor-buying-habits-1971-revealed>

<sup>4</sup> The biggest tractors available on <https://www.farmmachinerylocator.co.uk> are 300 HP or greater.

<sup>5</sup> <https://www.agriland.co.uk/farming-news/hands-free-farm-completes-first-major-operation-despite-covid-delays>



## Chemical arsenal

Modern industrialised farming is only possible because of the chemical industry. First there is synthetic nitrogen fertiliser, made possible by the Haber-Bosch process invented in the first decade of the twentieth century. This method of manufacturing ammonia from atmospheric nitrogen and hydrogen (produced from methane in natural gas) meant that food production was no longer dependent on animal manures, legumes and a healthy soil to provide nitrogen in the form needed by plants. Artificial fertilisers can provide nitrogen, potassium and phosphorus but not the organic matter needed for a living soil. Not only that, but artificial nitrogen fertilisers stimulate soil microbes to decompose the organic matter that provides structure to the soil by holding the mineral particles together in clumps, with the result that the soil is less able to hold water and nitrogen.<sup>6</sup> Artificial fertilisers contribute to greenhouse gas emissions because of the energy (supplied by fossil fuels) needed to produce them, the carbon dioxide produced from the methane (natural gas) from which the hydrogen used to make ammonia is made, and because their use results in the formation of nitrous oxide in the soil, a long lived gas which has a global warming potential 298 times that of carbon dioxide.<sup>7</sup> In addition widespread use of fertiliser has resulted in excess nitrogen in soils, in which rarer species are outcompeted by fast growing grasses etc. This applies to field margins, road verges and woodland, not just the land to which fertiliser is applied. Artificial fertilisers have resulted in a loss of biodiversity over the whole countryside, not just on the land on which they are used.

Next there is the arsenal of chemicals used on crops: herbicides directed at unwanted plant species, insecticides at insect pests and fungicides at fungal disease. These have provided quick and easy solutions for farmers to what were previously intractable problems. Spraying with herbicide has cut the need for the hard labour of weeding a crop, or scything thistles or nettles in pastures. However, nature has fought back and many weeds and pests have become resistant to the chemicals used so they are less and less effective. Meanwhile the damage to 'non-target' species has been immense, from the impact of organochlorine pesticides on birds of prey in the '50s and '60s to that of neonicotinoids on pollinators in the last few decades, let alone

their effects on the invisible life in the soil. The use of pesticides and artificial fertilisers are linked: artificial fertilisers have enabled crops to be grown on the same piece of land year after year, without the grassland break which used to be required to restore soils. Without this break the pests, diseases and weed species build up and need to be managed by application of pesticides and herbicides.

Keeping large numbers of animals in close proximity, such as happens in intensive chicken, pig and dairy farms, is only possible because of modern medication, including antibiotics. The widespread use of antibiotics in agriculture threatens their effectiveness for treatment of human infections plus the antibiotics persist in the dung of treated animals and will affect microbes in the soil the dung is spread on. Less widely appreciated is the impact of the medication given to grazing livestock on soil health and wildlife. For example, many farmers routinely treat their animals with wormers containing ivermectin. These can be bought over the counter at agricultural suppliers and applied to cattle simply by pouring it on their backs. But ivermectin and chemicals used to treat fluke and other parasites go through animals and come out in their dung where they kill dung beetles and other insects which should incorporate the dung into the soil. The dung then sits around on the soil longer, so any parasites in it are more likely to be able infect other animals, the soil does not benefit from the dung, and birds and other insect-eating animals are deprived of dung beetles to eat. As with herbicides, the medication becomes less effective over time as the parasites build up resistance.

## New breeds of plants and animals

Along with the chemical arsenal have come new varieties of crops, bred to give high yields if given lots of fertiliser. They have been bred by selecting the traits required and tend to have very little genetic diversity, each seed being very similar to the next, so a disease can wipe out a whole crop if not dealt with by a pesticide. It is not only crop species where new varieties have come to the fore. Pastureland has been re-sown with high performance strains of ryegrass, which produce massive amounts of grass when treated with fertiliser, but are effectively 'green deserts' when it comes to any other life. This grass contains few of the micro-nutrients that are essential for health.

<sup>6</sup> <https://grist.org/article/2010-02-23-new-research-synthetic-nitrogen-destroys-soil-carbon-undermines>

<sup>7</sup> Application of manure, if not properly managed, can also result in emissions of nitrogen dioxide, but because artificial nitrogen fertiliser is essentially unlimited its contribution is greater.



For livestock, traditional breeds that were adapted to conditions in a particular area have given way to ones that give faster growing, more productive animals. But these tend to be more prone to disease and more likely to require feeding with high-nutrient feeds. James Rebanks illustrates this with dairy cows: in the early 1950s the largest herd in their area had around thirty shorthorns. These were ‘dual purpose’, producing three to four gallons (13 to 18 litres) of milk a day each but also calves which could be raised for beef. Shorthorns were replaced by more specialist Friesians then, from the 1990s by North American Holstein cattle. These can produce nine or ten gallons a day (up to 45 litres). Rebanks says:

*“It is worth pausing for a moment to process that. It took 10,000 years of domestication and gradual selective breeding to create a cow that gave four or five gallons of milk per day, but in my lifetime that amount has doubled. Few people outside farming have registered how incredible this change is.”* (Rebanks, 2020, p.136)

Producing so much milk puts an enormous strain on dairy cows: lameness and mastitis is common and they are generally worn out after two or three years and are slaughtered. In contrast a healthy cow can live for 20 years.

Genetic modification and gene editing are ways to accelerate this process of producing high-yielding strains of plants and animals. It results in animals and plants that have even less genetic diversity and resilience to changing conditions.

### Changes to farming practices

Mechanisation, the new chemicals and selective breeding have together facilitated a specialisation in farm businesses. Most dramatically, the mixed farm which kept livestock and grew crops has declined. In the UK, there has also been a big regional split, with the east side of the country now being almost all arable farms and the west mainly producing livestock. Within livestock farming there has also been greater specialisation, with farms losing things like the chickens and pigs they used to keep, these now being reared predominantly in large scale intensive units.

For arable farming a major change has been from spring to winter crops (sown in autumn). If crops are sown in the spring, the winter stubble provides some habitat for birds and other wildlife, as well as some food in the form of spilt grain. In contrast, the small green shoots of autumn sown crops provide little cover or food. For livestock farming a key change has been from making hay to feed animals over winter to producing silage. Silage is fermented grass: the grass can be cut far earlier than it would be for hay and put straight into a silage clamp or large black plastic bag to ferment. As well as requiring less labour to make, and being less weather-dependent than hay, it is a more nutritious feed. However, the earlier cutting means that flowers in what were hay meadows do not have time to flower and set seed, so die out. And what comes out of the back end of the cow or sheep is very different. The hay resulted in dung that was full of roughage. When animals are housed inside, the dung can be stored in a muck heap before putting on the fields. In contrast, dung from animals fed with silage and high protein concentrates is too rich in nitrogen: it is a slurry that has to be stored in a lagoon or spread on the fields straight away. But, rather than improving those soils, its acidity kills earthworms and degrades the soil structure so it becomes compacted. Unlike a firm cow pat, slurry is not incorporated into the soil structure by dung beetles.<sup>8</sup>

### Results of changes

This industrialised agriculture has succeeded in feeding the European population after the devastation of the Second World War, to the extent that we are now overfed, consuming more calories than we need.<sup>9</sup> It has allowed big farms, and large companies in other parts of the food chain to prosper. From all other points of view it has been a disaster: it has degraded soils; increased flood risks; polluted water and air; led to the loss of wildlife, and the decline of agricultural communities. Animals are kept in conditions which do not allow them to behave in ways natural to them. Even on the food front, while most (but not all) of us have plenty of food, many do not have healthy diets: we eat too much meat, dairy products, sugar, and processed foods and not enough fruit and vegetables and our food is contaminated by pesticides linked to diseases such as leukemia, Parkinson’s and Alzheimer’s.<sup>10</sup>

<sup>8</sup> See <https://www.northernrealfarming.org/events/what-could-your-dung-beetles-be-doing-for-you>

<sup>9</sup> Hence the diet proposed by Poux and Aubert, 2018 involves reducing the calories consumed by the average European.

<sup>10</sup> See p.31 of Poux and Aubert, 2018 for a discussion of the health impacts of pesticides.



Bigger machines, artificial fertilisers, herbicides and pesticides have all destroyed life in the soil, so that the once common sight of sea gulls following a plough to eat the worms exposed is now rare. These 'soils' are really just chemically dependent dirt, requiring continued chemical inputs to produce a crop. Degraded soils do not hold water and are easily eroded by heavy rain, exacerbating droughts and floods and polluting water courses. The loss of insect life, directly as a result of the impact of pesticides, and indirectly through the loss of the wild plants (the weeds exterminated by herbicides) on which they rely means a loss of the pollinators we need for food production and less food for all the wildlife that depends on them. The impact of agriculture on wildlife is illustrated by a decline in farmland birds of one third between 1990 and 2017, while populations of woodland bird species have not decreased.<sup>11</sup>

The use of synthetic nitrogen fertilisers and the importation of high-protein animal feeds from South America<sup>12</sup> means that Europe's nitrogen cycle is out of balance. There is too much nitrogen being applied to land in Europe as artificial fertiliser or slurry from housed animals. Nitrogen leaching from soils into water bodies causes eutrophication, which can have severe consequences for aquatic life, and nitrogenous compounds, such as ammonia and nitrous oxide, released into the air cause air pollution and contribute to climate change (Poux and Aubert, 2018, p.27).

The decline in the agricultural workforce and in the number of farms is shown in Box 1. As small farms have gone out of business their land has been taken over by bigger farms, which have grown larger. This decline has happened despite the subsidy payments made to farmers under the Common Agricultural Policy, which in many cases are all that are keeping farms from going out of business.

However, size does not give immunity to business failure: James Rebanks talks about a pig farm in Cumbria that in ten years went from 5,000 to 120,000 pigs, becoming simply a place where pig feed was hauled in and pigs hauled out using a fleet of trucks. But this farm later went bust (Rebanks, 2020 p.123 and 141). In 2020, during a boom in pork sales one very big producer has been put out of business by an even bigger one.<sup>13</sup> According to James Rebanks 'the big new farms had a high staff turnover because the work

## Box 1: Decline in farms and in agricultural employment

**In UK there were 1.35 million employed in agriculture in 1950 but just 0.5 million in 2010**  
(<https://ourworldindata.org/employment-in-agriculture>)

### Between 2005 to 2016 in the EU

- The share of people employed in agriculture fell from 5.7% to 4.4%.
- The number of people employed fell by one third.
- The number of farms fell by one quarter.
- The number of farms with over 100ha increased by about 18%.
- The amount of land in agricultural use remained about the same.

In 2016 about 9.7 million people were employed in agriculture in the EU but a further 20.5 million regularly worked on farms, mostly on a part time basis.

The steepest decline in farm numbers was in Slovakia and Bulgaria which lost almost two-thirds of their farms, but Poland lost the greatest number, at 1.1 million. Most of the farms lost were less than 5ha in size. (But note that the figures for farms lost may be skewed by an increase in the threshold for what counts as a farm.)

[https://ec.europa.eu/eurostat/statistics-explained/index.php/Farmers\\_and\\_the\\_agricultural\\_labour\\_force\\_-\\_statistics#Fewer\\_farms.2C\\_fewer\\_farmers](https://ec.europa.eu/eurostat/statistics-explained/index.php/Farmers_and_the_agricultural_labour_force_-_statistics#Fewer_farms.2C_fewer_farmers)

[https://ec.europa.eu/eurostat/statistics-explained/index.php/Farms\\_and\\_farmland\\_in\\_the\\_European\\_Union\\_-\\_statistics#](https://ec.europa.eu/eurostat/statistics-explained/index.php/Farms_and_farmland_in_the_European_Union_-_statistics#)

<sup>11</sup> <https://www.eea.europa.eu/data-and-maps/indicators/abundance-and-distribution-of-selected-species-8/assessment-1>

<sup>12</sup> Poux and Aubert (2018) say that 35 million hectares in Latin America grow soya to feed Europe's livestock. The nitrogen in the soya is adding to the nitrogen in the environment in Europe through the manure of the animals that eat it, as is the nitrogen in synthetic fertilisers.

<sup>13</sup> <https://www.theguardian.com/environment/2020/oct/27/how-does-one-of-the-worlds-biggest-pork-firms-go-bust-during-a-boom?>



was now deskilled, boring and dirty... immigrant workers came and went without anyone really knowing their names'. There was more of a division between workers and the 'farmers' who employed them, the latter becoming business people who sat in an office behind a computer doing little of the hands on work themselves. And the relationship with farm animals had changed: they were no longer individuals but simply 'units of production' (Rebanks, 2020 p.128 and p.139).

Because a farm has not gone out of business does not mean that it is not suffering financially. Across the EU the average income from farming activities of a full time farmer in 2018 was only around half the average wage.<sup>14</sup> Many hang on to farming beyond the point where it is really giving them a living because the farm is their home, and it defines who they are. There are many farms that are only still in existence because of subsidy payments, of income gained off the farm, and the free labour of family members. In the film, *Nowt but a Fleeting Thing*<sup>15</sup> a dairy farmer on a tenanted farm in Cumbria talks about how he has probably been the last generation able to earn a living and support a family from farming without having to have an off-farm job. He is still farming, working an 80 hour week at 73 years of age because he can't afford to retire.

With the decline in the number of farms and the on-farm workforce has come a decline in agricultural communities: those people bound together in a particular area because they share an interest in the livestock they keep, the crops they grow or in managing the land. Rural communities have either withered, losing population, shops, schools and services, or been radically changed so that those involved in farming are now marginalised by commuters, retirees or people working in sectors unrelated to agriculture.

Farmers have become isolated, seeing few people in the course of their daily life and this, along with financial difficulties, has clearly taken a toll on their mental wellbeing. The suicide rate amongst farmers is high across Europe. In France campaigners in 2016 claimed that 600 farmers a year commit suicide<sup>16</sup> and in the UK the suicide rate of those working in agriculture is almost twice the national average.<sup>17</sup>

## Causes

What has driven these changes in agriculture? One clear cause is the drive for increased productivity following the war years. Government policy has, in various ways, incentivised farmers to produce more: from agricultural subsidies linked to production to grants for land 'improvements' – removing hedgerows, installing drainage, straightening rivers. But this drive for productivity, for increasing the yields from animals and crops, has also been internalised by farmers. The American farmer, Gabe Brown, talking about his early years of practicing the conventional model of farming says:

*"I chased higher yield when growing crops and more pounds when raising beef. Everywhere I turned, the message of increasing production was pounded into me. Magazines, newspapers, radio, universities, extension service, agricultural agencies, everywhere and everyone was telling me that I had to produce more "to feed the world." Stacked GMO traits, hybrid grain varieties, foliar fertiliser, seed treatment, larger equipment..... It is the same with livestock: performance-tested bulls with the highest expected progeny differences (EPDs), genome testing, total mixed rations with the latest ionophores, all designed to produce more, more, more!"* (Brown, 2018, p.174)

James Rebanks' grandfather instilled in him the idea that a farmer was as good or bad as his farm, and a good farm meant well drained land, plentiful crops, lush green grass and healthy livestock (Rebanks, 2020, p.38). He gives examples of peer pressure from their community to modernise the way they farmed: the 'combine man' complaining of the weeds in their field and telling them they ought to use herbicides to get a 'clean' crop (p.61), neighbours asking when they were going to make their silage and him being embarrassed that it was not yet ready and that they still made some hay (p.109). Then there was the feeling that they were falling behind and would never have enough money to keep up, that they were just too poor (p.52).

Alongside the push for increased productivity from government policy there has been consolidation in the agricultural supply chain and in the markets

<sup>14</sup> [https://ec.europa.eu/info/sites/info/files/food-farming-fisheries/farming/documents/cap-indicators-doc-c26\\_2018\\_en.pdf](https://ec.europa.eu/info/sites/info/files/food-farming-fisheries/farming/documents/cap-indicators-doc-c26_2018_en.pdf). Note many farm businesses may have income from other activities, such as property.

<sup>15</sup> <https://www.theguardian.com/global/video/2019/nov/18/nowt-but-a-fleeting-thing-a-young-farmers-fight-for-survival-video>

<sup>16</sup> <https://www.thelocal.fr/20160226/french-farming-hit-by-600-suicides-a-year> and <https://www.youtube.com/watch?v=OmBwvda9FkE>

<sup>17</sup> <https://www.theguardian.com/environment/2019/mar/03/brexit-and-bad-weather-puts-uk-farmers-at-risk-of-suicide-say-charities>



for agricultural products. Following decades of mergers and acquisitions, just four companies globally account for 44% of commercial seed sales, 62% of agrochemical sales and 56% of sales of farm machinery and 55% of sales of animal health products.<sup>18</sup> When it comes to selling their products, farmers face similarly powerful mega corporations. For example, in 2012 just four companies, Archer Daniels Midland (ADM), Bunge, Cargill, and Louis Dreyfus were thought to control 90% of the global grain trade.<sup>19</sup> Most food retail is now dominated by large supermarket chains: in Britain the eight largest supermarket chains sold 93% of groceries in 2018. One of these, Tesco, had 27% of the market. (Lang, 2020 p. 357). In France two companies have over 40% of the market, and eight over 90%.<sup>20</sup> In Germany the situation is similar with four companies having 70% of the market.<sup>21</sup> Big retailers demand uniform crops from farmers and a consistent supply: they have the power to influence how farmers farm<sup>22</sup> and it is easier for them to deal with a small number of big farmers rather than many small ones.

This consolidation has enabled prices for inputs to farming to go up and what farmers receive for

their products to do down, so that the share of food chain value in the EU going to agriculture dropped from 31% in 1995 to around 21% in 2019.<sup>23</sup> A 2017 report by the International Panel of Experts on Sustainable Food Systems concluded that:

*Consolidation across the agri-food industry has made farmers ever more reliant on a handful of suppliers and buyers, further squeezing their incomes and eroding their ability to choose what to grow, how to grow it, and for whom. ... The high and rapidly increasing levels of concentration in the agri-food sector reinforce the industrial food and farming model, exacerbating its social and environmental fall-out and aggravating existing power imbalances.* (Mooney, Clement and Jacobs, 2017)

What alternatives are there to this modern industrialised farming system? In the following two sections I discuss two approaches developed by farmers and landowners trying to regain control of their costs, lives, and farming so it is better for them and for nature.

### 3. Regenerative Agriculture

Regenerative agriculture is an approach to farming that puts the health of the soil at the heart of the farming system. In many of its practices, regenerative agriculture is a form of agroecology – it aims to work with local ecosystems.<sup>24</sup> However, agroecology<sup>25</sup> has become associated with small scale agriculture and a political movement. With the exception of organic farmers, who see what they do as a version of agroecology, it is not a term used by many larger farmers who are happy to say that they practice regenerative agriculture. In some ways regenerative agriculture can be seen as reincorporating some of the elements of mixed farming systems, but in other ways, such as the use of cover crops, no-till arable systems

and rotational, or ‘mob’ grazing it is not going backwards but forwards to new ways of farming.

The four principles of regenerative agriculture have been listed as:<sup>26</sup>

**1 Limit disturbance** because disturbing the soil, such as through ploughing, destroys soil structure. In a healthy soil, particles of clay, silt and sand are clumped together in aggregates held together by carbon-based glues produced by the micro-organisms in the soil. Pore spaces between the aggregates allow the infiltration of air and water. Ploughing disturbs this structure and lets lots of air into the soil which accelerates the

<sup>18</sup> Elsheich and Ayazi, 2018. The figures of the market share of those companies in 2013 that now are part of BASF, Bayer (after its take over of Monsanto) Dupont (after merger with Dow Chemicals) and ChemChina after its purchase of Syngenta.

<sup>19</sup> Murphy, Burch and Clapp, 2012

<sup>20</sup> <https://www.statista.com/statistics/778198/market-share-supermarkets-hypermarkets-chains-france>

<sup>21</sup> <https://www.statista.com/statistics/505129/leading-companies-in-food-retail-germany>

<sup>22</sup> For example, the farmer in Case study 2 says he has to use nitrogenous fertiliser on his wheat to get the protein content of wheat high enough for it to be acceptable to millers, though it is possible to make bread using flour of lower protein content.

<sup>23</sup> Van de Velde and Holemans, 2019.

<sup>24</sup> See for example <https://www.agroecologyfund.org/what-is-agroecology>.

<sup>25</sup> <https://www.soilassociation.org/causes-campaigns/a-ten-year-transition-to-agroecology/what-is-agroecology>

<sup>26</sup> These are taken from Abram 2020. Brown, 2018 has five principles, with ‘armour’ (keeping the soil covered with crop residues) and ‘Living roots’ listed separately. Much of the discussion here is taken from Brown, 2018.

degradation of these glues by bacteria, releasing carbon dioxide. The growth of weeds may be stimulated by the release of soluble nitrates from dead micro-organisms. The destruction of soil aggregates reduces the porosity of the soil, making it more anaerobic and less able to hold water. Anaerobic conditions increase denitrification in which nitrate in the soil is converted to the gas nitrogen, a process which also produces nitrous oxide, a powerful greenhouse gas. Ploughing also disturbs the network of mycorrhizal fungi which play a critical role in enabling plants to derive nutrients from the soil. Soil is also disturbed by the addition of agrochemicals: nitrogenous fertilisers reduce mycorrhizal fungi because, in providing nitrate to plants, they reduce the amount of surplus carbon-compounds that plants otherwise exude through their roots and which feed the mycorrhiza (Prescott et al, 2020); pesticides are toxic to various forms of soil biota so disturb the soil ecosystem.

**2 Keep the soil covered** through growing cover crops and through leaving crop residues on the soil. Ideally there should be no bare ground at any time of year. Having living roots in the soil, all year round if possible, is important to feed the soil biology.

**3 Increase diversity** of both plant and animal species as much as possible. Diversity of plant species can be achieved by cover crop mixtures containing perhaps twelve plant species (see Case Study 1) as well as increasing the types of crops grown, (together, as in companion planting, or in rotations), animals kept and adding trees.

**4 Integrate animals** because animals are always part of natural ecosystems and grazing animals in particular have a key role to play in improving soil health.

For any farmer wishing to move away from conventional industrialised agriculture to a more regenerative system, implementing these principles is not easy, takes time for the soil to improve and usually involves compromises of some sort. Unlike organic agriculture, with its lists of approved and prescribed practices, regenerative agriculture is about a direction and a journey. One of the pioneers, the American Robert Rodale, defined it as ‘a holistic approach to farming that encourages continuous innovation and improvement of environmental, social, and economic measures’.<sup>27</sup> Dan Burdett, who in 2020 had a Nuffield

Scholarship looking at why farmers made the change to more holistic, regenerative practices said:

*“Of the farmers I met, 90% weren’t organic. The majority of arable farmers still used some form of chemical input, preferring to keep all the tools at their disposal, but always looking to minimise their use over the medium to long-term. This makes RA accessible to all, and with no paperwork or inspection it is something that a farmer can start at any time and work out their own set of rules. This is in contrast to organic where the rules and regulations would certainly deter many farmers from making that transition. (Burdett, 2020.)*

Conventional arable farmers using ‘no-till’ methods – where seeds are drilled directly into the residue of the previous crop, with no ploughing or cultivation of the soil – generally use a herbicide such as glyphosate (the only broad spectrum herbicide available to them in the European Union) prior to planting a ‘cash crop’ – one they are growing to sell off the farm (see Case Studies 1 and 2). Many organic farmers find that they need to do some form of ploughing to control weeds at a point in their crop rotation, though they may plough to a shallower depth than has become normal practice (Soil Association, 2018). There is ongoing research into how no-till methods could work in an organic farming system.<sup>28</sup> The farmer in Case Study 3, John Letts, has managed to grow heritage wheat on the same field using a no-till organic system for six years, planting the crop in the autumn into the chopped up residue of the previous year’s crop then undersowing with clover.

Cover crops can provide grazing for animals in the winter. Grazing does not simply take biomass by feeding, reducing what is left: when grazing is managed in the right way it can enable the soil to produce more than it otherwise would have done, because it stimulates plants to pump more carbon into the soil, feeding the soil biota (Brown, 2018 p.3). Much of the biomass grazed is quickly returned to the soil as dung and urine, both of which contain nutrients in a form which plants and the soil biota can use. Incorporating clover and grass leys (temporary grassland) into arable rotations, as done in traditional mixed farming systems and in organic farming, builds up carbon in the soil, improves soil health and reduces the

<sup>27</sup> <https://rodaleinstitute.org/why-organic/organic-basics/regenerative-organic-agriculture>

<sup>28</sup> <https://thefarmingforum.co.uk/index.php?threads/is-organic-no-till-possible.306574>





prevalence of the pests and diseases of arable crops. Rather than keeping a herd in a relatively large field for perhaps a month, animals are confined to a small area, using an electric fence,<sup>29</sup> then moved every day, allowing time for grass to recover and grow tall before the animals graze it again. Tall plants mean longer roots systems which can more effectively obtain water and nutrients from the soil. Productivity is increased because the amount of photosynthesizing a plant can do is proportional to the amount of green leaf it has – so a bigger plant makes more biomass every day than a small one. The aim in these sorts of grazing systems is not for all the grass to be eaten when the animals are on it, but for about fifty percent of it to be trampled down. Along with the dung and urine from the animals the trampled plant matter feeds the biomass in the soil, adding to its carbon content. Keeping animals closely packed together, in a mob, mimics the natural behaviour of herd animals who, if there were predators around, would stay close together, hence these rotational grazing systems are often called ‘mob’ grazing.<sup>30</sup> Because the animals are moved away from their dung every day their burden of parasites is reduced.<sup>31</sup> George Hosier, the farmer in Case Study 1 says that, since changing to this style of grazing, he has been able to stop applying artificial fertiliser to his pastures with no loss of grass growth, and to stop using worming medication, resulting in an increase in dung beetles and in wildlife.

Non-grazing animals such as pigs and chickens can also play a role in regenerative farming systems. Gabe Brown, a North Dakotan farmer who has been a pioneer of regenerative agriculture, keeps chickens to which he feeds grain screenings, which would otherwise be wasted. In the summer they are put on the pastures grazed by the cattle a few days after the cattle to eat the fly larvae that have developed in the cow pats. He also keeps pigs which in the spring use the pastures where his cattle have been feeding on bales of hay in the winter. The pigs stir up the residue of hay and manure, removing the need to harrow the land. In tree shelter belts the pigs root through old decaying wood, stimulating growth of grass and herbs (Brown, 2018, p.86 and 89).

Gabe Brown tells the story of his journey into regenerative agriculture in his 2018 book, *Dirt to Soil*. He emphasises that farmers should focus

on profit per acre, rather than on maximising yield. Increasing profit cannot be achieved with monocultures that rely on expensive inputs but by building up a diversity of enterprises that are synergistic with each other. He gives a ‘cash flow’ statement that shows how carbon (rather than money) flows through thirty ‘products’ for Brown’s Ranch. Gabe Brown, his wife, their son and his partner can manage all these different enterprises because they have radically cut down the amount of work needed. He lists some of the many things that they don’t have to do:

*“we don’t have to haul and apply fertiliser, pesticides, and fungicides. We don’t need to vaccinate and worm our livestock. We don’t spend days chasing around the country to find the latest and greatest bulls, rams, and boars. We don’t pregnancy test the cow herd, pigs, or sheep. We don’t have daily chores of starting up farm equipment to haul feed to the livestock during the winter. We don’t have to spend time hauling manure from the corrals out to spread on the fields...”* (Brown, 2018, p.195)

A study of corn farmers in the North American Plains found that profits were best correlated with soil organic matter content, not with crop yield. In regenerative farming systems that did not use insecticides pests were less abundant than in insecticide-treated corn fields. Fields farmed regeneratively did produced 29% less grain but gave 78% higher profits than conventionally farmed fields (See LaCanne and Lundgren, 2018).

The normal business assumption, that has driven many farmers to try to increase their yields, is that the way to increase profits is to increase output. Why this does not work in farming is explained in a report on hill farming in the UK commissioned by a group of conservation organisations. The authors of the *Less is More* report (Clark and Scanlon, 2019) examined the accounts of 29 hill farms and Farm Business Survey data of a further 17 farms to identify fixed and variable costs, income from the farming enterprise and other income (such as payments under the EU Common Agricultural Policy and income from non-farming activities such as letting accommodation). For almost all the farms examined, if the farming activities alone are considered the farms would be making a loss were

<sup>29</sup> Alternative systems have been developed which avoid the use of an electric fence: animals instead wear a collar with a GPS and battery that gives them an electric shock if they go beyond the boundary the farmer sets on the system [accessed via his mobile phone]. Before they get an electric shock the animals are played some music and, once trained, most turn around at this point. See <https://www.nofence.no/en>

<sup>30</sup> For more on mob grazing see Chapman, 2012.

<sup>31</sup> <https://www.fwi.co.uk/livestock/grassland-management/a-guide-to-mob-grazing-livestock>



it not for agricultural support payments. Some are making a loss even with these payments. The cost of the farmer's own labour was not included in these calculations. However, the report reveals that farmers tend not to analyse their business accounts, instead looking only at total revenue against cost, so do not realise that their farming activities are losing money (p.12). Sam Beaumont (Case Study 4) seems to be unusual in keeping good records of how much he spent on his sheep and therefore knowing how little net profit he had made on them.

The study found that many farmers assume that their variable costs are linear, increasing in proportion to their output. So if they increased their output sufficiently they should get to a point where they start to make a profit. However, this is not the case. Up to a certain point, which the authors call the maximum sustainable output (MSO), farmers make use of free natural resources, of grass growth in the case of hill farms, and incur 'productive variable costs' – the essential /unavoidable costs linked to their farming system. To increase production above this point they have to buy in more resources – fertiliser, herbicides, additional feed, more medication. For UK hill farms (and possibly for many other types of farming) these costs are higher than the value of the additional output they make possible. That is, farmers would be better off financially if they produced less. However, even at the MSO, most of the farms examined would make a loss were it not for support payments. To be viable without support payments they would need some combination of an increase in the price paid for their outputs, reduction of their fixed costs or an increase in environmental payments.

Farmers are often motivated to switch to more regenerative practices because of a desire to cut costs, though this can lead on to an interest in soil health and in making their land better for wildlife. Regenerative agriculture has clear benefits for the environment over the current industrial model and enables farmers to farm more profitably but, at least initially, this switch is likely to reduce on-farm labour, as regenerative agriculture is about getting nature to do more of the work so the farmer has less to do. This may be countered by diversification of farm outputs which mean more jobs can be supported. Diversification can add work at times of

year when there is otherwise little work, enabling full time, year round employment. For example, Whitehall Farm in Cambridgeshire has found that the integration of apple trees, planted in rows to form windbreaks, into its arable and vegetable-growing business, has enabled them to employ a full time person all year round because there is plenty of pruning and management of the trees to do over the winter. Unlike the wheat and barley they grow, they can add value to their apples themselves by processing them to make juice and opening a farm shop to sell direct to the public.<sup>32</sup> A diversity of enterprises on a farm makes work on it more varied and more interesting, particularly given the continual experimentation, learning and innovation that characterises regenerative agriculture. It therefore has potential to provide high quality, knowledge-based work.<sup>33</sup>

Making farm businesses more viable and able to retain a higher proportion of what they can get for their output will stop farms going out of business and increase good quality employment in agriculture. An example of where this has been achieved is White Oak Pastures farm, owned by one of the pioneers of regenerative agriculture in the USA, Will Harris. This now employs 155 people in Bluffton in southern Georgia, regenerating what was a fast declining small town. Twenty years ago his farm did not even make enough to employ him full time, but he turned this around through a switch to regenerative agriculture. Mob grazing by cattle restored the degraded soil and increased output, enabling Will Harris to buy up neighbouring land, so that White Oak Pastures now covers 3000 acres (1200 Ha) and is the largest certified organic farm in Georgia. They raise sheep, pigs, poultry and rabbits as well as cattle (ten different animal species in all), and grow vegetables. A big part of how White Oak Pastures manages to employ so many people is because it has its own on-farm slaughterhouse employing 120 of the 155 people. The slaughterhouse gives them control of the process to the finished product and means that they are zero-waste, ensuring all the animal carcasses are used, with inedible viscera composted (finding a use for this compost made them start growing vegetables). As well as employing so many people they have contributed to the regeneration of Bluffton through restoring the old Bluffton General Store which sells general groceries as well as their own products.<sup>34</sup>

<sup>32</sup> See p.40 of Food, Farming and Countryside Commission, 2021.

<sup>33</sup> Greenham and Link [2020] argue that in agroecological enterprises what are 'operatives' in industrialised agriculture become 'knowledge workers' whose know-how is essential in the experimentation, fine-tuning and learning processes that increase productivity in these farming systems [p.49-50]

<sup>34</sup> See <https://www.whiteoakpastures.com> plus p.7-8 of Burdett, 2020.



## 4. Farming for Nature

In regenerative agriculture, the aim is to be profitable by reducing inputs and building up the natural capacity of the land to produce good quality food. Producing food is still key but the idea that the yield of a crop or growth rate of livestock should be maximised has been abandoned. In what I am calling ‘farming for nature’, the production of food no longer has centre stage. Instead, food is a by-product of activities whose main aim is to maintain or restore particular species, habitats or natural processes.

Though modern farming is highly destructive, the abandonment of farming in areas where it has had a long history does not necessarily improve things for the natural world. Habitats such as species-rich limestone grassland or hay meadows become less biodiverse if farming ceases. The decline in grazing by goats and sheep in Mediterranean areas such as Greece has resulted in an increased risk of wildfires (Colantoni et al, 2020) and a decline in biodiversity.<sup>35</sup>

In many places in the UK cessation of grazing and of the practice of cutting bracken to use as winter bedding for livestock results in a monoculture of bracken, a fern that is not eaten by any grazing animals,<sup>36</sup> not the regeneration of woodland that some might expect. Trees cannot establish because they are shaded out by the bracken and are eaten by wild deer. Reintroducing grazing by the right sort of cattle can keep the bracken in check because the cattle (unlike sheep) are big enough to trample the bracken. In other places their hooves create pockets of bare ground in dense swards of grass where trees can become established. Whereas sheep graze grassland down to a short sward, cattle rip with their tongues, leaving some of the plant left that can go on to flower.

The Burren on the West Coast of Ireland is an area with rocky uplands of limestone pavements which have a particularly rich flora of wild flowers and associated insect life. It has been grazed as part of extensive farming systems for 6000 years but in the 1990s much of this had ceased as farmers had either left or switched to rearing fast-growing breeds of cattle on the lowlands, treating their

fields with artificial fertilisers to maximise grass growth and making silage – resulting in pollution of water courses by fertiliser and slurry. The biodiversity of the upland limestone areas had declined. This decline has been reversed by a ‘payment by results’ system that uses EU funds to pay farmers for species-rich fields and clean water. In response farmers have re-instated the practice of “winterage”, where cattle graze the rocky uplands in the winter, eating the tough, hardy grasses so there is more space for the rare flowers which appear in the spring. The heat absorbed by the limestone in the summer makes them warmer than most uplands are in the winter. Critical to this system has been a change of mindset on the part of farmers, away from seeing what they are doing as just about producing food. One local farmer, Michael Davoren is quoted as saying: “In the past, the environment was a by-product. In the future, the environment is what we’ll be producing, and the food will be a by-product.”<sup>37</sup>

Similarly, the cattle and sheep owned by Cath and Bill Grayson who run the Morecambe Bay Conservation Grazing Company in North West England (see Case Study 5), are primarily raised to be conservation volunteers: they do produce meat, but this is a by-product of their role in maintaining species-rich habitats through their grazing. In contrast to the ‘mob’ grazing of farmers practising regenerative agriculture, which constrains a herd to a relatively small area at any one time and is designed to restore productive, healthy soils, in conservation grazing cattle range over a wide area and can choose the grasses, herbs, and tree-leaves that they want to eat. Their grazing keeps in check vigorous grasses that would otherwise out-compete wild flowers, tramples down bracken or rushes that would otherwise take over and checks succession of species-rich grassland to scrub. On areas of rough grassland, for example, cattle often graze the herb-rich coverings of ant-hills. Without this grazing the ant-hills become overwhelmed by grasses and the ant colonies die.<sup>38</sup> Cattle can be much more effective conservation volunteers than humans. For example, Cumbria Wildlife Trust, in trying to restore heathland on their Eycott Hill Nature reserve that had been overgrazed by

<sup>35</sup> See references cited in Hadjigeorgiou, 2011.

<sup>36</sup> Bracken contains several toxic compounds, though wild boar will eat the rhizomes [see <https://en.wikipedia.org/wiki/Bracken> and <https://www.woodlands.co.uk/blog/woodland-economics/wild-boar-and-woodland-regeneration>]. The lack of wild boar in most of the UK may be one reason why bracken is such a problem.

sheep, have had more success from introducing Belted Galloway cattle than more labour-intensive techniques, such as disturbing the ground with machinery and then spreading cut heather.<sup>39</sup>

Having a wide variety of plants available to eat, including the leaves of trees and shrubs, means that grazing animals are able to find more of the nutrients they need and self-medicate when they are ill. This results in healthier animals, who are less likely to require veterinary medication, and whose meat and milk provide more nutrients for the people who consume them (Provenza et al. 2015). However, the ability to graze difficult ground and find sufficient nutrients is something that animals have to learn. It also takes a while for their digestive systems to develop so they can cope with the poorer quality herbage that may be all that is available in winter.<sup>40</sup> For this reason, and because animals grow more slowly on less fertile land, conservation graziers such as Bill and Cath Grayson keep their animals for longer than the 36 months which is considered the upper limit for prime cattle. This can result in the meat not getting the top price you might expect: it is less tender than that from younger animals and needs slow and careful cooking, so is not favoured by supermarkets.

On arable farms too farming practices can be changed to benefit nature. This has been demonstrated by the conservation organisation RSPB, who in 2000 bought Hope Farm in east Cambridgeshire, a predominantly arable area, to trial and demonstrate nature friendly methods of farming. In contrast to the ongoing national decline in farmland birds, Hope Farm saw a 226% increase in birds and a 213% increase in the numbers of butterflies up to 2017.<sup>41</sup> This has been achieved by, among other things, increasing the diversity of the crop rotation, increasing spring sowing over winter sowing, retaining winter stubble, growing cover crops, better management of hedgerows and ponds, and managing 10% of the land specifically for wildlife to provide flower-rich areas in the summer and seed-rich areas for birds in the winter. Organisations such as the Nature Friendly Farming Network in the

UK<sup>42</sup> and Farming for Nature in Ireland<sup>43</sup> have been set up to promote such practices and give a forum for farmers to learn from each other.

Simply reverting to more mixed systems can improve biodiversity. For example, the RSPB suggest that farmers in livestock areas should grow some arable crops, perhaps to provide feed for their animals, while in predominantly arable areas they suggest converting arable to grassland.<sup>44</sup> What many of the wild birds the RSPB is seeking to protect need is a mix of different habitats.

Changes to arable farming practices to encourage wildlife and practices such as conservation grazing tend to be directed at maintaining or restoring particular habitats or providing for particular species. In contrast, rewilding aims to restore natural processes that are dynamic and lead to continual change. Rewilding is not the abandonment of land, rather it requires active intervention to introduce key species or remove blockages to natural processes. For example, in Ennerdale, a valley on the West side of the Lake District in Cumbria, one key action of the 'Wild Ennerdale' Project<sup>45</sup> has been to remove a culvert upstream of the lake, Ennerdale Water and replace it with a single span bridge. This has restored the natural flow of sediment in the river, creating a dynamic environment in which islands appear then are washed away. Not only has this improved water quality, with Ennerdale Water remaining clear when other lakes in the area are full of sediment during periods of extreme rainfall, such as Storm Desmond in December 2015, but the numbers of spawning Arctic char increased from a handful to over 500 within three years. Most of Ennerdale above the lake was coniferous forestry plantation which is gradually being felled. Regeneration by native woodland has required planting of native trees to provide a source of seed. Roe deer in the area need to be culled or they would prevent this regeneration. There are three herds of Galloway cattle, introduced to create disturbance and increase diversity. Where they have been grazing for more than 10 years there has been a 65% increase in bird species and a doubling of the number of birds.<sup>46</sup>

<sup>37</sup> [https://www.theguardian.com/environment/2020/jun/06/food-will-be-a-by-product-the-irish-farmers-creating-nature-friendly-fields?utm\\_](https://www.theguardian.com/environment/2020/jun/06/food-will-be-a-by-product-the-irish-farmers-creating-nature-friendly-fields?utm_)

<sup>38</sup> Bill Grayson, 2020, pers comm.

<sup>39</sup> Presentation by Kevin Scott given to Restoration and Rewilding conference, Murley Moss, Kendal on 14 February 2020.

<sup>40</sup> Note, animals in conservation grazing systems are generally outside all winter, rather than being housed.

<sup>41</sup> [https://www.rspb.org.uk/globalassets/downloads/documents/conservation--sustainability/hope-farm/hopefarm\\_farming.pdf](https://www.rspb.org.uk/globalassets/downloads/documents/conservation--sustainability/hope-farm/hopefarm_farming.pdf)

<sup>42</sup> <https://www.nffn.org.uk>

<sup>43</sup> <https://www.farmingfornature.ie>

<sup>44</sup> <https://www.rspb.org.uk/our-work/conservation/conservation-and-sustainability/farming/advice/techniques-to-help-wildlife>

<sup>45</sup> <http://www.wildennerdale.co.uk>

<sup>46</sup> <http://www.wildennerdale.co.uk/wildlife>





The Ennerdale Galloway cattle are, in ecological terms, substitutes for the aurochs (wild ox) that once roamed Europe, but they are looked after and, at the end of their lives, they are taken away for slaughter and used for meat, as they would be in a farming system. Rewilding in the UK has not followed the example of Oostvaardersplassen in the Netherlands, where grazing herbivores have been allowed to die of starvation at the end of winter, causing public controversy. In her book, *Wilding* (Tree, 2018), about the Knepp Wildland Project in Sussex, Isabella Tree defends the practices of Oostvaardersplassen: she argues that starvation is part of the natural process and is the fate of wild herbivores when food is short even when ecosystems include predators of those herbivores; what is important is not the manner of their death but that the animals have a free life in a natural environment, and the carcasses are an important part of the ecosystem. But at Knepp they realised that allowing animals to starve in winter would not be politically acceptable in an area crossed by public footpaths with domestic gardens backing onto it. Oostvaardersplassen is grazed by Heck cattle, a breed developed to be as close as possible to the extinct aurochs, but which can be aggressive to people and their dogs. Instead Knepp have docile English longhorn cattle. Knepp were forbidden by UK legislation from introducing wild boar so instead they have Tamworth pigs to disturb ground and increase biodiversity. Cattle and pigs are slaughtered for their meat but, like the cattle of the Morecambe Bay Grazing Company, they are primarily there to perform a role in the ecosystem.

The Knepp Estate used to be a conventional dairy and arable farm but, despite the best efforts of its owners to increase production and add value through making ice cream, it was losing money. In 1999 they were visited by a veteran tree specialist who pointed out that all their old oaks were in a poor condition because the land around them was being ploughed and doused with chemicals for arable production. This catalysed a rethink by the Burrells that led to the sale of the dairy herds and farm machinery in 2000, the restoration of parkland in the area around the veteran trees in 2001 and then, from 2003, the gradual cessation of arable production over the rest of the 3500 acre (1400 hectares) estate and the creation of the Knepp Wildland Project. The scale of the Knepp Estate is important – it is much larger than most UK nature reserves. As well as longhorn cattle and pigs, the Burrells introduced red deer and Exmoor ponies, after allowing the growth of scrub vegetation for a few seasons following cessation of arable farming.

The pigs and grazing animals prevent a succession to closed canopy woodland. Instead they create a more diverse woodland pasture habitat that is a shifting mosaic of woodland, scrub and grassland.

The result of allowing natural processes to take their course has been that Knepp now supports a vast array of wildlife, including several species which are in precipitous decline elsewhere in the UK. The most important of these are the turtle dove, the nightingale and the purple emperor butterfly. Tree explains how the habitats of these species at Knepp are often not those that they are normally thought to need. For example, the purple emperor is considered to be a butterfly of ancient, closed canopy woodland but at Knepp it is found in emerging willow scrub. Nightingales, thought to require coppiced woodland, have taken up residence in overgrown hedges where there is thorny cover right down to the ground. They also have peregrine falcons, birds that are thought to nest on cliffs, nesting in a pine tree. This illustrates how much we don't know about nature. Rather than forming a view about what we want to achieve then managing things so as to try to achieve it, perhaps we should more often try to work with nature by removing the obstructions we have created to natural processes and letting nature take its course.

The Knepp Wildland project has been very influential in Britain, not least as a result of Isabella Tree's book, *Wilding*. There are many similar large estates who communicate with and learn from each other. The Lowther Estate in Cumbria, for example, has embarked on what looks like a similar strategy, using longhorn cattle and Tamworth pigs, that they are calling Wildland farming (Case Study 6). Also in Cumbria, Gowbarrow Hall Farm is developing a hybrid of regenerative farming and rewilding: in the summer their cattle graze their better land using a mob grazing system and in winter they are allowed to roam freely on their large area of less productive, higher land where there are also some ponies and, in the woodland, a couple of pigs. Their aim for this less productive land is to restore a woodland pasture ecosystem (see Case Study 4).

The Knepp project can be criticised for its impact on those who formerly worked on their farms: in a radio interview<sup>47</sup> Tree talks about how one of the hardest things they did was to make their farm manager redundant. One of their sources of income is the letting of residential property previously occupied by their farm workers (Fairlie, 2019a). At the Lowther Estate, the conversion of their home farm land from conventional sheep and arable to



Wildland farming has not been at the cost of jobs, though some roles have changed. Farming for nature does address the biodiversity and climate crises but in many instances will provide fewer direct jobs than conventional farming. In marginal areas, though, where farming on the conventional model is going out of business, farming for nature can retain some farming jobs though it is

likely to rely on receiving public funding for the environmental benefits it provides in biodiversity, flood prevention and carbon sequestration. It perhaps has the potential to provide many more jobs in nature-based tourism and recreational activities: the Knepp Estate reportedly gets as much income from eco-tourism as it does from meat sales, or from agricultural subsidies (Fairlie, 2019a).

## 5. The role of livestock in sustainable farming

In recent years there has been an increasing awareness of the impact of animal farming on our emissions of greenhouse gases, with many arguing that the best thing for the climate would be if we stopped eating meat and milk products entirely and all became vegan. This is the implication of publications such as *Food and Climate Change without the Hot Air* (Bridle, 2020),<sup>48</sup> which is a guide to the greenhouse gas emissions associated with the different foods one might eat for the different meals of the day. One problem is that the data it is based on reflects how food is currently produced, in the modern industrialised farming system, not how it could be produced in a more sustainable, regenerative system. Another is that it takes foods in isolation, whereas foods are produced as part of farming systems that should produce a diversity of interdependent products. It is the emissions of the whole system, including those of external inputs (such as fertilisers, pesticides and bought-in animal feed) that should be measured. We should aim for the lowest emission system and then eat the outputs of that, rather than trying to measure emissions of individual foods. And as well as climate change we need to consider impacts on biodiversity and animal welfare, requiring some compromises to be made.

A good case for animals having an important role in sustainable farming systems has been made by Simon Fairlie in *Meat a Benign Extravagance* (Fairlie, 2010).<sup>49</sup> Fairlie has several decades of practical experience of small scale farming and argues for 'default' livestock: livestock that consume wastes or surpluses, or are grazed on land that is unsuitable for crops or is part of a rotational system. Livestock fed in these ways can play an important role in

recycling nutrients or building soil fertility. If we limit livestock to those that can be fed in this way then their environmental impact is small. It is when meat consumption grows to the point where we need to grow crops specifically to feed to animals that livestock's environmental impact balloons. We do need to eat less meat, but that does not mean it would be better if we ate none.

As has been outlined in this report, grazing animals have a particularly important role to play in restoring soil health. This is not to say that overgrazing cannot do real damage – many parts of the UK uplands have indeed, in the words of George Monbiot, become 'sheepwrecked' – nibbled down to almost nothing and soils compacted by too many sheep (Monbiot, 2013). But when managed well, grazing by the right sort of animals can increase biodiversity and improve soil health. When they consume plants animals 'burn' some of the carbon in the plant to provide themselves with energy and end up with more nitrogen than they need to build their bodies, so they excrete nitrogen in the form of urea thus returning it to the soil. Grazing animals also contribute the bacteria from their rumens to the soil. Animals (the whole soil biota as well as grazing herbivores) thus increase the nitrogen:carbon ratio in the soil. Increasing the nitrogen available for plant growth means that plants are then able to extract more carbon dioxide from the air through photosynthesis.<sup>50</sup> Arable systems that do not use artificial nitrogenous fertilisers struggle to maintain soil fertility without grazing livestock at some point in their rotation. Many can benefit from incorporating grazing by livestock in other ways: for example, trials in Scotland have found that grazing

<sup>47</sup> Desert Island Discs, 29 November 2019 <https://www.bbc.co.uk/programmes/m000bltf>

<sup>48</sup> For my review of this book see <https://www.greenhousethinktank.org/food-and-climate-change-without-the-hot-air.html>

<sup>49</sup> For my review of this book see <https://www.greenhousethinktank.org/meat-a-benign-extravagance.html>

<sup>50</sup> There is a good explanation of this on p.11 of Chapman 2012.



sheep during the winter on the fresh shoots of winter cereals increase yields of the cereals. The young plants grow back stronger after being grazed and the sheep, which also eat some of the weeds.<sup>51</sup>

The importance of grazing livestock means that the diets recommended in agroecological proposals for feeding Europe (Poux and Aubert, 2018) and for feeding the UK (Food, Farming and Countryside Commission, 2021) include grass-fed beef and sheep. In contrast, pigs and chickens, often thought to have a lower environmental impact, cannot just be fed on grass. Instead, most are fed on soya meal, imported from South America, where its production drives the destruction of rainforest. As the farming systems discussed in this report show, pigs and chickens do have roles to play in regenerative agricultural systems, but these are generally not as fundamental as those of grazing animals. When not eating grubs picked up from cow pats, worms from soils or (for pigs) acorns they find in woods, pigs and chickens should be given domestically produced feed, made with material that is not suitable for human consumption, or is surplus to our requirements.

In Brindle's assessment of the greenhouse gas emissions of beef, the major contributory factor is the methane produced by a cow's digestive system. Cattle, and other ruminant animals, such as sheep, goats and deer, have a specialised stomach called a rumen in which their food ferments to enable them to digest it. This process produces methane which is a potent greenhouse gas, much more powerful than carbon dioxide. The amount of methane produced per kilo of beef depends on what the animal has eaten (there is ongoing research as to whether particular herbs or tree leaves, or the addition of things like seaweed to the diets of cattle and sheep can reduce methane emissions) and how long it has lived. The latter means that the longer lived, extensively grazed cattle raised by conservation graziers such as the Morecambe Bay Conservation Grazing Company (see Case Study 5) produce more methane than more intensively raised animals that grow faster and are therefore slaughtered when younger.

The farmers in Case Studies 1 and 5, interviewed as part of this project had two responses to the

issue of methane produced by their cattle.<sup>52</sup> Bill Grayson, from the Morecambe Bay Conservation Grazing Company, said that an assessment of greenhouse gas emissions that included the whole landscape their cattle are part of, as well as emissions from the animals themselves, showed that overall carbon was sequestered. He felt that what they were doing was mimicking what would have been there naturally: ruminant animals would have been part of the natural ecosystem before the landscape was farmed and did not then cause climate change. George Hosier, from Wexcombe Manor Farm, made the argument put forward by many in the farming community, which is based on work by researchers at Oxford University and others,<sup>53</sup> to the effect that the way the warming impact of biogenic methane, such as that produced by cattle, is equated with emissions of carbon dioxide from the burning of fossil fuels is wrong. The argument is that because this methane is converted to carbon dioxide in a matter of decades, with a half life of around ten years, what matters is changes in methane emissions, not their absolute value. A herd that has not increased in size for a few decades will not increase methane concentrations in the atmosphere because the methane emitted by the animals today will just replace that emitted by the herd a couple of decades ago. The carbon dioxide produced by oxidation of the methane does not contribute to global warming because it is part of the contemporary carbon cycle, having recently been taken out of the atmosphere by photosynthesis in the plants eaten by the cattle. If herd sizes are increased that will increase methane concentrations and hence global warming, while reductions in herd sizes will reduce it.

Methane can also be produced from the anaerobic degradation of manure. This is more likely to be the case where animals are housed inside and their dung has to be stored in large quantities, allowing anaerobic conditions to develop. Where animals are grazing outside it is less likely that methane will be produced, particularly if the animals are dunging on healthy soil in which the dung is quickly incorporated into that soil. George Hosier makes the case that healthy soils contain methanotrophs, bacteria that quickly break down methane produced by the degradation of the dung or directly by the cattle.

<sup>51</sup> [https://www.sruc.ac.uk/news/article/2797/multiple\\_benefits\\_of\\_winter\\_cereal\\_grazing](https://www.sruc.ac.uk/news/article/2797/multiple_benefits_of_winter_cereal_grazing)

<sup>52</sup> For the films of these interviews see <https://www.greenhousethinktank.org/a-just-transition-in-agriculture.html>

<sup>53</sup> See for example Fairlie, 2019b and <https://www.carbonbrief.org/guest-post-a-new-way-to-assess-global-warming-potential-of-short-lived-pollutants>. The latter explains the scientific paper by Allen et al, 2018 which proposes a new way of comparing the Global Warming Potential of Short Lived Climate Pollutants (SLCP) such as methane with that of carbon dioxide, which they call GWP\*.



## 6. Moving away from maximising food production

Both approaches to the future of agriculture that I have discussed move away from idea that the aim should be to produce as much food as possible. Farmers practising regenerative agriculture have realised that, beyond a certain point, focusing on increasing yields reduces, not increases, their profits and instead they need to focus on cutting down on their inputs and improving soil health. Nature then does more for them, enabling them to farm profitably. In farming for nature food has become a by-product, not the main aim of the farming activity. This move away from maximising food production goes against the oft-stated view that we need to increase food production in order to feed a growing world population. The idea that we should be producing food from farmland, not giving that land over to nature was one factor behind the considerable local opposition to the Knepp Wildland project. Isabella Tree quotes a letter to the Country Times:

*“When it was farmed first by Sir Merrik and then Sir Walter and Lady Burrell, [Knepp] was an estate admired and worked by people proud of its high standard of farming and general care... In this day and age when we are asked to grow all the food we can, to save importing and help feed starving countries, he has turned a fine working estate into a wasteland ...Someone needs to stop him.” (Tree, 2018 p.131)*

Simon Fairlie has expressed similar, though more measured, concerns about rewilding in Britain:

*“The UK only produces 60 percent of the food it eats. If that level of production were to drop further as a result of large scale rewilding and similar environmental schemes, then the most likely scenario is that the UK would make up the balance with imports from elsewhere. In a post-Brexit Britain, many such imports will be unsustainably produced – South American soya and beef, Indonesian palm oil, Californian almonds, or sugar from land-grab plantations in Africa, for example. If, by rewilding at home, the UK increases its dependence on imported food, we will be outsourcing our environmental impacts and creating pressure*

*for dewilding somewhere else. On a global scale it will be a zero sum game.” (Fairlie 2019a)*

But the fact that many farmers are struggling to make a profit and that so much food goes to waste, suggests that the issue is more complex than insufficient local food production. For a start diets have shifted from being locally specific: the whole world, not just Italians, now eats pasta and pizza. In the UK imported pasta and rice have to some extent displaced UK-grown potatoes, not because we can no longer grow enough potatoes, but because diets and fashions have changed. Northern Europe imports vegetable oils from southern Europe whereas it used to rely on local animal fats, which now often have to be disposed of by incineration (Fairlie, 2010 p.23). Becoming more locally self-sufficient in food is not simply a matter of increasing local production, but changing how the food system works, and our diets. Globally we already produce enough food to feed 10 billion people but a great deal is wasted, from being left in the fields to rot because the price the farmer can get is so low it is not worth harvesting, to that thrown out by supermarkets because it is past its ‘sell by’ date, to all those salad leaves and half-full jars that go off in our fridges.<sup>54</sup> We don’t need to produce more food as the world population grows, just to cut down on waste and to stop feeding human-edible food to livestock.

In their modelling of how Europe could feed itself by 2050 using agroecology – cutting out pesticides, synthetic fertilisers and import of plant protein for animal feed – IDDRI have assumed that yields will be lower than current average yields. However, Europe could still feed 350 million people while improving biodiversity and reducing the pollution caused by agriculture through changing diets to one which is much more healthy: increasing fruit and vegetable consumption, reducing dairy products and radically reducing the amount of pork and chicken (Poux and Aubert, 2018, p.43).

Aiming for maximum output from agriculture has been disastrous for wildlife, the climate, rural communities and the quality of our food. In a rational world we would aim to produce just what we need – and ensure that everyone has access to it – not more.



## 7. A Future for Agriculture?

Debates about the future of agriculture are often framed as whether to ‘spare’ or ‘share’: to produce the food we need intensively on as small an amount of land as possible, so that other land can be left for nature; or to farm more land in a less intensive fashion so allowing wildlife to share it with us. This seems to me to be a false choice, primarily because modern intensive farming is not sustainable in terms of the energy and other resources it uses and its impact on air and water quality. So its continuation is not a long term option. In the livestock sector we have a false idea of the amount of land intensive livestock production uses: it is not just where the pigs, chickens, cattle and sheep are housed, but all the land, often in tropical countries, that is used to produce the feed that they eat: intensive livestock production may enable rewilding here, but at the expense of wild land elsewhere. Intensive agriculture depends on fast growing, highly productive breeds of plants and animals but the maintenance of these breeds relies on the more genetically-diverse traditional breeds. Without more traditional forms of agriculture keeping those breeds going, modern intensive forms would have nowhere to go for the genetic resources needed when their chemical arsenal no longer stops their animals and plants succumbing to disease.

Instead farming needs to be done in a way that builds the health of the soil to wean it off dependency on synthetic inputs: these regenerative farming practices are good for wildlife as well as the profitability of the farm. They have the potential to produce a greater diversity of food from the same farm. There are also opportunities to grow other sorts of crops: fibres such as flax or hemp for textiles; willow or miscanthus grass for energy production, and for farmers to use their land for renewable energy systems such as wind turbines and solar photovoltaics, around which at least some farming activities can still take place (for example, sheep do well on pastureland that has ground-mounted solar farms on it). In some places certain farming practices are needed to maintain particular habitats or species: the conflict between farming and wildlife can be a false one.

To encourage the shift to regenerative farming and revitalise farming communities, I suggest that one of the most important things may be to stop the trend towards ever larger companies upstream and downstream of agriculture, and the increasing size of farm holdings themselves. For this we can all do what we can to support small scale farmers and food retailers through what we buy. We need to develop stronger links between urban and rural communities, such as through Community Supported Agriculture (CSA),<sup>55</sup> in which producers receive a fair and steady income from consumers, in return for a share of the produce. In CSA the responsibilities, risks and rewards of farming are shared between producers and consumers. CSA is particularly suited to the production of fruit and vegetables near urban areas and, because vegetable production is labour intensive, it has the potential to create jobs.

But individual action alone will not be enough: government policy also needs to change. Stronger competition policy is needed to stop mergers and acquisitions in the agricultural supply chain and in food retail, to support the break up the current mega-corporations and the creation of new independent ones. Ideally, this should be a co-ordinated, global effort, but Europe could do much on its own. For example, individual countries could clamp down on supermarkets to ensure they give their suppliers a fairer deal and prevent them from outcompeting independent retailers through things such as selling popular products at a loss.<sup>56</sup>

Regenerative agricultural practices could be supported by a strategy to reduce the chemical arsenal used by agriculture: for example artificial fertilisers, herbicides and pesticides could be taxed to reflect the damage they cause to soils, the environment and our health. This would tilt the scales in favour of those farmers who do not use them; veterinary medicines such as dewormers should be less easily available to livestock farms and their use require veterinary supervision, so they are only used when animals are actually sick.

<sup>54</sup> Berners-Lee 2019, p. 12-15 contains a good overview of how much food is wasted where.

<sup>55</sup> See for example, [www.communitysupportedagriculture.org](http://www.communitysupportedagriculture.org).

<sup>56</sup> For example the UK has a Groceries Code Adjudicator, <https://www.gov.uk/government/organisations/groceries-code-adjudicator/about>, but its powers should be strengthened.



We need to find ways to pay farmers for the wildlife on their land, for holding back flood water, sequestering carbon and the other benefits they provide. There are at least two schemes in Ireland that include a 'payment by results' element, the Burren programme and the Hen Harrier Project.<sup>57</sup> Post Brexit, England is set to transition its farm support payments to the Environmental Land Management Scheme, (ELMS) the principle of which is 'public money for public goods', removing the area based farm support payments.<sup>58</sup> Depending on the details of this, which have yet to be finalised, this has the potential to support farming for nature and nature-friendly farming practices.

Agriculture is not an industry; it is the basis of our civilisation and culture. Too many of us have lost contact with it, with how our food is produced and the land that produces it. The culture of agricultural communities is very different from those of post-industrial areas, but like the latter, they have suffered from substantial declines in jobs. There is a danger that, feeling ignored by the prosperous cities, those in rural communities who have lost out turn to political extremists who seem at least to give them someone to blame for their plight. The decimation of agricultural communities is therefore something that we should all be concerned about. Agriculture needs a just transition, as

much as coal mining communities, but whereas there is no future for coal mines in a zero-carbon world, there has to be a future for agriculture.

One vision of the future is for food to be produced by more and more intensive systems on less and less land, or in factories growing 'synthetic meat'.<sup>59</sup> Aside from whether these visions are realistic, worldwide they would mean the loss of billions of rural livelihoods and further migration to urban areas. Instead, a just transition has to involve a reversal in the decline of employment in agriculture, and I suggest the best hope for this, and for restoring nature and tackling the climate crisis, is regenerative farming on better land, able to provide year-round employment through a diversity of enterprises and, on less productive land, 'farming for nature', supported by public payments for the public benefits it provides.

It should be easier to become a farmer, particularly for those without capital assets. There is a need for training in regenerative agriculture (which should include ecology, something generally lacking from the agricultural curriculum), apprenticeships and ways into becoming a farmer for those without capital, such as tenancies of small farms.<sup>60</sup> A vibrant, living and working countryside, providing food, space for wildlife and good jobs will be to the benefit of us all.

<sup>57</sup> <http://burrenprogramme.com/the-programme/our-approach/> and <http://www.henharrierproject.ie>

<sup>58</sup> <https://www.gov.uk/government/publications/the-environmental-land-management-scheme-an-overview>

<sup>59</sup> See Ireland, 2019. This mentions the issue of the nutrient serum from which the cells of artificial meat are grown, which currently includes animal blood. A key issue is where are the ingredients of the serum come from, as well as the energy consumed by this way of producing 'meat'.

<sup>60</sup> The tenancy of a small farm is what enabled Cath and Bill Grayson (Case Study 4) to become farmers. Their farm was owned by the National Trust, a conservation organisation that is a large landowner in England. Many County Councils in England used to own a network of small farms which they let out to young and first time farmers, sometimes at below market rents, enabling people to get a start in farming. Unfortunately, the number of these has halved in 40 years – <https://whooownsengland.org/2018/06/08/how-the-extent-of-county-farms-has-halved-in-40-years>. The Ecological Land Co-operative (<https://ecologicaland.coop>) is attempting to fulfil some of this function. They buy up land then split it into small holding plots for people wanting to set up their own ecological land-based business.





# Case Studies

# Case Study 1:

## George Hosier, Wexcombe Farm, Wiltshire

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George Hosier and his father  
Photo: Event Amplifier

**Wexcombe Farm was purchased by George's grandfather a hundred years ago. He now runs the 1500 acre (625 Ha) mixed arable and beef arm with his parents, plus they employ two part time and one full time farm workers.**

George was aware that their farm business was only viable because of the subsidy payments they received and was worried that these might not continue so he started to look at how he could cut costs. One big cost was preparation of the soil, the ploughing and cultivation prior to planting a crop. His 'lightbulb moment' came when he saw a video of someone planting wheat directly into a field of standing mustard. Wexcombe Farm purchased a seed drill that could do this and in 2014 tried out this 'no-till' method of planting directly into the residue of the previous crop on half of the land they were sowing that autumn. As there was no reduction in yield they have now stopped ploughing all their land. That was the start of a journey of learning about soil and how full of life a healthy soil should be.

Previously their arable rotation was wheat for two years, a year of barley then a 'break crop', which was normally oil seed rape. They have now added oats, linseed and peas to this, with half of their crops being autumn sown and the other half spring sown. Most importantly they now sow cover crops, which consist of a mixture of perhaps twelve species (including brassicas, legumes, phacelia and grasses such as oats) after harvesting a cash crop. These increase the diversity of plants grown in the soil and mean that the soil is not left bare at any time of year. Plus they provide winter grazing for the cattle and food and cover for wildlife.



Previously their cattle just grazed on their permanent pasture. Now they are incorporating grass into their arable rotation to improve the soil. The aim is to have all the land down to grass at one point in a 15 year period but to achieve this need to increase the size of their breeding herd of Hereford cattle from their current 160 animals. They used to put the cattle in a big field a month at time but have now changed to a rotational 'mob grazing' system where all the animals are kept (using an electric fence) in a relatively small area then moved once a day. They do not go back to the same land for about sixty days, which is time for the grass to regrow to the point that it is starting to form a seed head.

This grazing system has allowed Wexcombe Farm to cease applying artificial fertilisers to the pastures, without loss of grass growth and to stop using wormers to treat the cattle. Because they are moved every day to clean pasture their exposure to dung that might contain parasites has decreased, reducing their burden of parasite. Stopping use of wormers has increased the number of dung beetles which help to recycle the dung and incorporate it into the soil. The cattle used to be housed in the winter but the aim is to keep them outside all year, though last year this was not possible because it was so wet. Another change is that they have shifted calving from January to April, when it can be done outside and there is plenty of grass.

The new system means they have cut their use of diesel and artificial fertilisers by 40%. They do still use some fertiliser on their cash crops (wheat and barley) and though they have cut out all insecticides and reduced herbicide use they still use a broad spectrum herbicide prior to planting a cash crop. The only suitable one they can use is glyphosate and, although this is detrimental to soil biology, George considers that it is not as bad for the soil as ploughing.

The wildlife on the farm has increased as a result of the changes they have made. They are seeing more barn owls, kestrels, red kites and buzzards, more song birds and more butterflies. They have also less soil erosion and the carbon content of their soils is increasing.

The changes they have made have not been without challenges. They have cut their costs and improved their margins but turnover has been reduced because they are growing less wheat and barley – the crops they make most money from. In the future George wants to increase diversity by having pasture-fed chickens following the cattle as well as planting more hedges and alleyways of trees within fields. He is also considering opening up his woodland to the cattle and perhaps having some pigs in the woodland as well. George is also looking at getting closer to his market, selling to local butchers or direct to consumers through a website.

### **Sources:**

George Hosier.

See a film of our interview with George at  
<https://www.greenhousethinktank.org/a-just-transition-in-agriculture.html>



# Case Study 2:

## David Lord, Earls Hall Farm, Clacton-on-Sea, Essex

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### **750 ha of land, part owned, part tenanted and part contracted, near the North Essex coast.**

David Lord manages the farming side of the business, Lord and Hunt, owned by two generations of his family. He is on the English steering group of the Nature Friendly Farming Network, chairman of Colchester branch NFU, and a steering group member for the Agriculture and Horticulture Development Board's (AHDB) Eastern strategic farm.

Until the late 1990s Earls Hall Farm had a herd of dairy cows and beef followers as well as producing arable crops, but in 1999 they sold their herd and expanded their arable production. In about 2014 they concluded that the way they were farming was not sustainable: their costs were increasing but yields levelling off; they had increased pressure from pest and disease, plus the weather was clearly changing with increased rainfall. David wanted to create a farming system that would see him through to his retirement and that could be taken over by the next generation.

One of their problems was blackgrass, a weed of arable crops. It had become resistant to most herbicides apart from glyphosate, a broad spectrum herbicide which cannot be used on a growing crop. The only way to use it is to switch to spring sowing, using glyphosate beforehand. On their heavy land this required that they grow something else over the autumn and winter to maintain the soil structure. This led them to using cover crops between harvest and spring sowing and to using no-till methods. Decreasing cultivation of the soil has resulted in fewer weeds. Yields have not diminished, but costs have been reduced. They are targeting fertiliser inputs better by mapping their fields by soil types, splitting them into different zones and testing the nutrient status of each zone, so each can be treated just with what it needs. They have increased diversity by increasing the number of different crops in their rotation and growing a diverse mixture of species as a cover crop. David thinks they could do with adding more livestock: they have had some sheep, owned by others, grazing their land but are not yet doing this on a large scale.

David has used the Cool Farm tool to assess the net greenhouse gas emissions from the winter wheat and beans grown on Earls Hall Farm. Both came out negative because the way the land is managed sequesters more greenhouse gases than are emitted. The main contributor to their carbon emissions is nitrogenous fertiliser, fossil fuel use being minor in comparison. David Lord considers that there is a need for more research on how to manage soils so as to increase nitrogen fixing bacteria and fungal content; healthy, active fungal systems being essential to break down residues into humus, which is how carbon is stored long term in soil. At Earls Hall Farm they need to use nitrogenous fertiliser on their wheat to achieve the 13% protein content demanded by millers for bread making, though bread can be made from lower protein flour.



The calculation of their net greenhouse gas emissions did not include the surrounding habitats. Including salt marsh, 12% of the farm is in conservation schemes. They have sown pollen and nectar strips in the fields and bird seed mix in field corners, as well as planting hedgerows and coppicing their woodland. They like their wildlife, but things like the pollen and nectar strips take quite a lot of work to maintain, work that they need to be paid for through the stewardship schemes if they are going to continue doing it.

Earls Hall Farm has also diversified into renewable energy: BayWa, a German agricultural company specializing in renewable energy installed a 10MW, 5-turbine wind farm in 2012, plus they have 14 kW of solar PV panels on farm buildings.

### **Sources:**

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# Case Study 3:

## John Letts, Heritage Harvest, Buckinghamshire

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**John Letts has grown wheat using low-input organic methods on the same land on a small farm in Buckinghamshire for six years. His approach goes against what has become accepted practice with regard to wheat: that it needs a highly fertile soil with lots of nitrogen and that you can't grow it on the same piece of land for more than a couple of years.**

Key to his approach has been the development of a genetically diverse landrace of wheat. To do this he first collected as many heritage lines of wheat that he could, screened out non-viable lines by growing them separately then combined them and grew them all together, saving seed from one year to plant in the next. In this way he developed a strain with a great deal of genetic diversity that can evolve to adapt to local conditions and withstand pests and disease. Heritage wheat is much taller than modern varieties. This means it has bigger root systems and can better outcompete weeds. However, if the seed heads they produce are too big they are likely to fall over, or 'lodge'. The more nitrogen in the soil the bigger the grains: there needs to be enough nitrogen to produce a decent crop, but not too much. In medieval times the wheat straw would have been used for thatch or animal bedding. John Letts chops it up and leaves it on the soil surface so it returns organic matter and some nitrogen to the soil. His crop is planted in early autumn, without ploughing and undersown with short white clover, to provide more nitrogen. He does not use any manure or artificial fertilisers, herbicides or pesticides.

The result has been a yield of about three tonnes per hectare. This compares with the average UK yield of just under eight tonnes per hectare. Organic farmers in the UK generally achieve five tonnes per hectare. Conventional farmers rely on high inputs of synthetic fertilisers and other agro-chemicals to achieve their yields, and even then generally don't grow wheat on the same land every year. Organic farmers only grow wheat one year in five: in three of the other years the land is down to grass and clover grazed by livestock and in the other year they grow another arable crop such as barley, oats, roots or beans. If just considering wheat, John Letts' system produces three times as much per hectare over a five year period as organic farmers who grow it as part of a rotation, and three-quarters of the amount produced by conventional farmers, if they grow it two years out of four. His costs are very low because there are so few inputs so he thinks that his profit margins are higher than for conventional farmers.





John Letts grew up on a farm in Canada, studied environmental science and botany then moved to London for a Masters degree in archaeobotany. He was working as a researcher at the natural history museum in Oxford when a friend walked in with a shoebox containing the base layer of thatch from a medieval roof. This had in it grains of wheat from as much as 600 years ago. This got John interested in reviving thatching with wheat straw rather than imported water reed. So he started to grow the heritage varieties that produce the long straw needed for thatching. The grain was a byproduct that he set about creating a market for, working with millers and bakers. He now grows heritage wheat on various bits of land across southern England. John is unable to sell his seed to other farmers because legislation requires that seeds offered for sale are registered and are 'distinct, uniform and stable', the very opposite of the heritage grains John has developed, which are diverse and constantly evolving. So John's seed is rented from him by other growers under 'seed user agreements'. In 2018 his heritage grains were grown on 65 ha of land, producing around 200 tonnes of wheat and were used to make flour, pasta, beer, gin and whisky. The flour is lower in gluten than modern flours but has a higher level of enzyme activity and is good for making sourdoughs. For many people who have developed gluten intolerance, bread made from these grains is more digestible, as well as being more tasty and nutritious than bread made with modern varieties of wheat.

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# Case Study 4:

## Sam and Claire Beaumont, Gowbarrow Hall Farm, Cumbria

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Gowbarrow Hall Farm  
Photo: Sam Beaumont

**Gowbarrow Hall Farm belonged to Claire's grandfather. When he died in 1998, the farm was let on annual grazing licences to other sheep farmers in the Ullswater Valley until Claire's grandmother also passed away in 2017.**

Claire then moved back to the farm with her husband, Sam, who she had met while working for an engineering consultancy, with the intention of taking on its management. Most of the farm work is now done by Sam, who used to help his parents run an organic sheep farm in Derbyshire, and Claire's father Richard Lloyd, while Claire works part time for the engineering consultancy.

Initially they started out farming as Claire's grandfather had done, with 300 Swaledale sheep and a few Shorthorn cows on approximately 100 hectares, with around another 100 hectares still let to other farmers. Sam could see that the land was overgrazed: for example there was no growth around the base of the alder trees that lined their streams, the soil was very compacted and the grass had very short roots. They were reliant on bought in fertiliser and concentrate feed to try to maintain productivity and had lots of problems with fly strike and other parasites, which required constant treatment with chemicals. Sam felt it was a continual battle to keep the sheep healthy. At the end of the year when he sold the lambs he had raised he made a net income of just £600, not including the cost of his time. However, he could see that the Shorthorn cattle had more potential - they seemed to fit the land better and required less intervention.



The Beaumonts, along with Claire's parents, Richard and Anne Lloyd, then decided to change how they farm. They wanted to restore nature to the farm, as well as try to make a better living. They had help from Wilderculture, an organisation which promotes an integrated approach to ecological restoration and food production in the uplands, combining regenerative farming with rewilding.

The first step was to sell their sheep and instead buy a few more Shorthorn cattle, and also take back all of the land so that they had the whole farm to graze. In the summer the cattle graze the lower pastures of the farm, near the shores of Ullswater, which formerly had been cut every year for hay or silage. They use rotational, 'mob' grazing, confining the herd to a relatively small area with electric fencing then moving them every day, not coming back to the same bit of land for at least 90 days. They now [October 2020] have a total of around fifty head of cattle. This grazing system should improve the soil biology and, over time, increase its productivity. The Beaumonts are using Soilmentor to track their progress (an App designed to help farmers monitor their soil health) and the early signs are that the strategy is working.

They have stopped applying artificial fertiliser and are cutting down on the use of wormers and fluke medication. The aim is to stop blanket treatments for parasites totally, but it will take time for the pasture to become healthier and the herd to build up resilience. Last year they did have to treat some of the stock in spring but put them in a separate area while doing so, to try to minimise the impact of the wormer on dung beetle and insect populations.

In the winter, the cattle are moved to the upper part of the farm, which rises to around 300 metres above sea level, where they are allowed to roam where they will and shelter in the woodland. This area was once a walled deer park and they want to restore it to open canopy wood pasture. In the summer it is not grazed at all except for a few fell ponies and pigs.

The aim is to transition to all year round grazing without additional feeding of hay in the winter, but they are still making hay in one of their lower fields, just in case it is needed in extreme weather. Their other livestock are currently four Kunekune pigs who live in their woodland, two castrated males and two females. The males will be sold for meat and the females bred from.

The Beaumonts and Lloyds have planted thousands of trees but are now trying to increase tree numbers by natural regeneration rather than more planting. They are working with the Woodland Trust to monitor the success of this strategy, which relies on keeping a check on the population of deer.

The 100% pasture fed meat from the farm's cattle is sold direct to consumers through their website and mailing list. It is Pasture For Life certified, a certification scheme of the Pasture Fed Livestock Association which guarantees that no human-edible grains are fed to the cattle.

### **Source:**

Sam Beaumont



# Case Study 5:

## Bill and Cath Grayson, Morecambe Bay Conservation Grazing Company

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Cath Grayson treating their bull to an apple  
Photo: Forgebank Films

**Bill and Cath met while studying ecology at university. Bill then trained as a teacher before doing a PhD in grazing ecology while Cath completed training as a nurse. Bill then went on to teach ecology at a field study centre in North Yorkshire where they started keeping livestock on land attached to the centre.**

During the following years, during which they moved several times, working for county Wildlife Trusts and on farms, Bill's conviction that farming should work in conjunction with the natural world grew. In 1992, now with three young children, they moved with their itinerant cattle, to Bank House Farm in Silverdale, a village on Morecambe Bay in North West England. Bill took up the role of National Trust warden, alongside the tenancy of the organic farm that was owned by the National Trust. They started with fifteen cows and 120 sheep, grazing local nature reserves as well as the farm and adjacent salt marsh. In addition to the farm and wardening work, Bill was also the North West Officer for The Grazing Animals Project and worked as an organic advisor for the government's information and advisory scheme. Cath continued working as a nurse, assisting with farm chores, and running the sale of beef, lamb, pork and poultry.

Silverdale is in an Area of Outstanding Natural Beauty characterised by limestone grassland and woodland. Over the past few decades commercial farming has undergone significant changes, intensifying production on the better quality land and specializing in the most profitable enterprises. This resulted in farming on land of poorer quality being





abandoned. Where grazing on this abandoned land had ceased the grassland that had been species rich was giving way to scrub and bracken. The conservation organisations who by now owned much of this more marginal land had come to realise that restoring the right sort of grazing was essential if the species diversity of the grassland and other habitats was going to be maintained.

After ten years at Bank House farm, Bill and Cath moved to their own house nearby from where they have set up the Morecambe Bay Conservation Grazing Company. This now has around 135 cattle plus a small number of sheep. These graze land owned by fifteen or so different conservation organisations and some sites owned by private individuals. The grazing agreements with these land owners vary widely from formal farm business tenancies to informal verbal agreements. In most cases the grazing must comply with the requirements of agri-environment schemes, for which the landowner receives the agri-environment payments, while the Graysons receive the farm-support payments known as the Basic Payment Scheme [BPS] that are available to all farmers. The BPS requires the land to be in 'good agricultural and environmental condition' which means that areas of dense woodland or of scrub or bracken are ineligible. So they can only claim the payments for about two thirds of the area they actually use.

Though they do produce meat from their livestock the main focus of the Grayson's business is delivering the conservation benefits from the grazing. Cattle manage grassland by eating the more vigorous grasses so other less productive species can compete. They also trample bracken and keep woody species in check, helping to slow or stop the succession of species-rich grassland to scrub and woodland. They also graze some woodland areas at certain times of year which increases the biodiversity of the woodland and enhances its structure. Browsing the trees is good for the health of the cattle because their leaves contain additional nutrients. The sheep are useful for grazing some of the smaller sites and are especially appropriate for putting on hay meadows in the winter to keep the grass short so that, come spring, it does not outcompete the flowers. They use a breed of sheep called Easy Care which was bred in the 1960s from Welsh Mountain sheep, a very hardy hill breed, and Wiltshire Horn sheep. They do not need to be shorn as they shed their fleece naturally in spring. The lack of the normal mass of wool around the tail and back of the hind legs means the blowfly has nowhere to lay its eggs as this area does not get soiled with faeces as it tends to in more heavily wooled breeds. This greatly reduces problems with fly strike and enables the Easy-Cares to keep their tails, which in most other sheep have to be docked to help keep them clean.

Most of the cattle are Red Polls with a few Shorthorns and Blue Greys. These are hardy British breeds that can cope with living out all year round in the tough conditions found on many of the sites they graze. As they mature they get better at utilizing the coarser unimproved vegetation and finding the nutrients they need to maintain themselves, although their growth rates are considerably lower than those of cattle on better ground. So while most farmers slaughter animals for beef before they get to three years old, Bill and Cath's cattle live a lot longer, continuing to grow at this slower rate over a much longer period of up to eight or nine years. Until the last few years the calves were weaned at around eight months, and given hay during their first winter; now however, weaning is postponed and the cows and calves

are allowed to stay together, grazing winter pastures without requiring any supplemental feeding. This results in much bigger and fitter calves when they are eventually weaned the following year, although it lengthens the time before the mother can be in calf again.

Some of the more fertile fields are used for making hay for feeding to older or weaker animals that need help to get through the lean months of winter. The process of hay making is crucial for conserving the species richness of the meadows that they manage, most of which have had their diversity restored after many years of more intensive management. The hay is stored in a barn located on a small area of wood pasture that the Graysons own in Silverdale. This is conveniently close to home for keeping an eye on animals that need more care because they are sick or near to giving birth. As well as traditional hay-making, they also cut and dry branches of tree leaves for use in the winter as 'tree hay', an addition to their diet that the cattle always like.

Because they are certified organic, Bill and Cath cannot treat animals with wormers or other medication unless the animals are actually sick. Fortunately however, the use of native breeds and the lower stocking densities mean they get very few problems with parasites. Cath thinks this is also due in part to having a closed herd, with each successive generation being bred from their own animals that have built up resistance to the specific parasites and diseases that they encounter on these particular sites. Ticks, for example, are plentiful at some of the sites and the cattle will inevitably get covered in them but they rarely get the tick-borne infections. When one of the cows did get sick with a tick-borne disease a few years ago, it was one of the few that had been bought in. Since then the only livestock they have been purchased is their Red Poll bull.

The ability of animals to access a wide range of different foods to eat is another factor that both Bill and Cath feel plays an important role in maintaining the health and vigour of their livestock. Apart from the wide range of herbs and grasses on the many different sites they can usually browse a great variety of trees and shrubs, many of which are known to be rich in certain minerals and trace elements. Some, like yew, are known to be poisonous when eaten by animals encountering them for the first time but Bill and Cath's cattle routinely browse yew wherever it grows without suffering any harm. Having access to a wide variety of plants enables them to 'self-medicate' when they need to fight off certain parasites or infections or when they are short of certain minerals or other key nutrients.

When the Graysons were at Bank House Farm they sold all of their meat directly to customers from the farm. This scale of marketing has not proved possible from their current home because of lack of space and time, so direct sales are restricted to just two to three cattle a year and about 20 sheep which are sold in small quantities to customers from the immediate locality. The majority of what they produce is sold into the commercial wholesale sector where, because the animals are older, their meat often goes into processed foods such as sausages, pies and baby feed rather than being sold as prime beef cuts. This is a slightly disappointing end result for what should really be a premium product because of its environmental credentials and high-welfare status. Unfortunately, what counts as high quality



today is determined mostly by supermarkets which value tenderness and succulence over the richer taste and texture that typifies meat from animals reared entirely from pasture, whose meat requires more skill to cook well.

Over the years Bill and Cath have had a number of trainees who have worked with them through different apprenticeship schemes, benefiting from a combination of work experience and specialist college-based training. Some of the ex-apprentices went on to work for conservation organisations, whilst others are now running their own grazing businesses. Bill and Cath are currently working co-operatively with three other conservation graziers in the local area, each having their own animals for grazing their respective sites but sharing some equipment and providing each other with practical help and support. The Graysons are also active members of local farmers' groups such as the Cumbria Farmer Network and The Morecambe Bay Facilitation Fund and Bill contributes to research linked to sustainable farming.

### **Sources:**

Bill and Cath Grayson.

See a film of our interview with Bill and Cath at

<https://www.greenhousethinktank.org/a-just-transition-in-agriculture.html>

# Case Study 6:

## Lowther Estate, Cumbria

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Lowther Estate  
Photo: Peter Leeson

**The ‘home farm’ area of the Lowther Estate consists of about 2000 hectares (5000 acres) on the west side of the Eden Valley in North West England.**

In the early 2000s it was an organic poultry, beef, sheep and arable enterprise employing sixteen people. However this lost money so in 2009 it converted to conventional sheep and arable. This also proved not to be financially viable and the decision was made to convert to what they are calling ‘Wildland farming’ – a very low input system that aims to restore natural processes. The sheep and all the farm machinery were sold off during the course of 2019 and 60km of fencing was taken down. Longhorn cattle were introduced plus six Tamworth pigs. The aim is to grow their cattle herd to between 110 and 120 breeding females plus their followers, but six adult pigs is probably enough to perform their role of increasing diversity in the landscape, so piglets, when grown, will be sold locally for meat or breeding. They also produce honey through the Lake District Honey Company, which has around 500 hives on the wider estate and surrounding areas, as well as the home farm area.

In October 2020 they introduced a pair of beavers (which were made extinct in Cumbria 400 years ago) into a 27 acre (11 hectare) enclosure consisting of woodland and wet grassland. This is a five year trial to monitor the impact of beavers on streams in a farmed landscape. Already the beavers are building dams to create pools which hold back silt and constructing canals to enable them to access woodland areas.



The Estate does regular surveys of wildlife and has already seen an increase in birdlife. The soils are holding more organic matter and the increase in vegetation cover means that soil was not washed away by the heavy rain in the autumn of 2020.

The Lowther Estate also has a castle, which is a visitor attraction and the changes on the home farm mean that the different parts of the estate are now working much more closely together, with those running the castle keen for their visitors to learn about the wider estate. There are now four employees on the farm side of the estate. This is a reduction from the organic poultry, beef, sheep and arable enterprise but not from the conventional sheep and arable one that followed it. There has been no loss of employment from the transition to wildland farming, though some roles have changed.

The Lowther Estate works closely with other large estates in the UK, exchanging information about new ideas, projects and their results. Those estates include Knepp in Sussex whose Wildland project started in 2001 and also uses Longhorn cattle and Tamworth pigs.

Because the costs of the farm are now minimal the income from beef sales is now creating profit. They also have income from Environmental Stewardship Schemes but hope not to be reliant on this in the future.

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