Received: 18 January 2023 | Revised: 16 October 2023 | Accepted: 23 October 2023

DOI: 10.1111/geoj.12558

THE GJ Royal Geographical Society with IBG

WILEY

ARTICLE

Farming for the patchy Anthropocene: The spatial imaginaries of regenerative agriculture

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Funding Information
This research was funded by the Wellcome Trust, Our Planet Our Health (Livestock, Environment and People – LEAP), award number 205212/Z/16/Z. For the purpose of open access, the author has applied a CC BY public copyright licence to any Author Accepted Manuscript version arising from this submission. The funding body played no part in the study design; in the collection, analysis, and interpretation of data; in the writing of the report; nor in the decision to submit the article for publication.

Abstract

With its focus on the species level of the Anthropos, there is growing concern that the Anthropocene analytic lacks the conceptual nuance needed to grapple with the unevenly distributed harms and responsibilities tied up with issues of biodiversity loss, global warming, and land use change. Conceptual variants like the patchy Anthropocene have been proposed to better capture the justice implications of these socio-ecological crises, directing attention to their spatially ubiquitous yet context-specific character. The figure of the plantation has come to play an important role in this scholarship due to the contribution intensive agriculture had made to these interlinking crises. Through empirical study of the regenerative agricultural movement, this paper reflects on how regenerative farmers use different sites (fields, soils, livestock stomachs) to apprehend their agro-ethical responsibilities to more-than-human actors both near to and far from the landscapes they manage. Our aims here are two-fold. First, we provide a more affirmative account of agricultural management than is currently offered by plantation farming: a model of food production that is not just 'in' the Anthropocene, but 'for' it. Second, we contribute to ongoing discussions unfolding in the social sciences around the tools needed to conceptualise the interlinking spatial and justice aspects of the Anthropocene transition. By bringing the patchy analytic into conversation with more established geographic writing on scale, volume, and horizontal connections, we show the merit of juxtaposing multiple models of spatial relation as a way of gaining ethical and conceptual traction on complex socio-ecological issues. We argue that the 'polymorphic' spatial imaginaries of regenerative agriculturalists can offer some guidance on the tools needed to attend to the specificity of local Anthropocene outcomes in relation to socio-ecological forces actuating the world at much greater spatio-temporal scales.

KEYWORDS

Anthropocene, patchy Anthropocene, regenerative agriculture, scale, spatial imaginaries, United Kingdom

1 | INTRODUCTION

We are moving fast into the Anthropocene and conventional, intensive agriculture is one of its main drivers (Willett et al., 2019, p. 244). While this model has led to vast increases in food production, there are growing concerns about its environmental, social, and political ills. These include the ecological simplification caused by deforestation and monoculture, climate change, zoonotic diseases, and the erasure of smallholder land ownership and indigenous and vernacular knowledge systems. Although the Anthropocene framing has assisted in the analysis of these problems, there is concern about the concept's explanatory power and critical potential (Haraway, 2015). Critics suggest that the focus it places on the species level of the *Anthropos* makes it ill equipped to map the uneven geographies of responsibility for climate change and biodiversity loss, particularly as their violent outcomes are distributed along axes of socio-economic status, gender, and race (Malm & Hornborg, 2014).

In light of these criticisms, the anthropologist Anna Tsing and her colleagues offer the concept of the 'patchy Anthropocene' (Tsing et al., 2019) as part of a wider project aiming to spatialise the Anthropocene transition (Tsing et al., 2021). Their intervention is driven by a recognition of the links between space and multispecies justice. They argue that without analysing the spatially ubiquitous yet context-specific character of the Anthropocene, scholars will remain 'naively beholden to its unitary pretensions' (Tsing et al., 2019, p. 190). Scholars have begun to deploy the concept of the patchy Anthropocene, alongside other spatiality sensitive alternatives like the Plantationocene, to critically examine the negative impacts of intensive agricultural systems that rely on the simplification, rationalisation, and exploitation of ecologies and societies (Barua, 2023; Chao, 2021). This literature argues that the plantation is founded on a parochial spatio-temporal logic, and that its pursuit of accumulation has generated harmful socio-ecological outcomes in the form of climate change, social inequality, and biodiversity loss.

In this paper we develop this move to spatialise the Anthropocene, but offer a more affirmative account of agricultural production. We focus on the regenerative agriculture movement that is emerging across the UK, the USA, Europe, Australia, and New Zealand. Regenerative agriculture promotes the salutary role of agriculture as a means to sequester carbon, improve soil health and biodiversity, and deliver a renewed contract for peaceable multispecies relations. The promises made in the name of regenerative agriculture figure as a direct response to the problems of the plantation and the diagnosis of the Anthropocene 'Great Acceleration'. While regenerative agriculturalists emphasise the need to attend to the context-specific ecological behaviours of the landscapes they manage, the principles they follow have been developed to attend to global issues of warming, biodiversity loss, and land use change (Gordon et al., 2022). Owing to this local–global, specific–structural, here–everywhere engagement, we cautiously present these farmers as model citizens for the patchy Anthropocene – those with an approach to food production not just 'in' the Anthropocene, but 'for' it (Maye et al., 2022).

To make the case, we focus on three spatial imaginaries that are common elements of the regenerative 'mindscape' (Gordon et al., 2022). These imaginaries configure how our farmers connect local managerial and ethical responsibilities to planetary-scale socio-ecological issues. Our aims in presenting the spatial strategies of these farmers are two-fold. First, we document some of the principles and practices we believe are needed for a model of food production fit for the patchy Anthropocene. Second, we contribute to discussions unfolding in geography and anthropology around the conceptual tools needed to account for the spatial complexities of the Anthropocene. While we rally behind attempts being made to spatialise the Anthropocene, we believe more work needs to be done to ensure the patchy Anthropocene analytic is up to the task.

We argue that both of these goals require a more sophisticated conceptual grammar of spatial relations than is currently offered in the writing on the patchy Anthropocene. To this end, we draw on established human geography scholarship on space and scale to describe the manner in which regenerative practitioners invoke (i) vertically nested frameworks, (ii) horizontal systems of networked connection, and (iii) volumetric models of three-dimensional space to guide their practice. We read these spatial imaginaries *out of* the strategies of regenerative agriculturalists as a way of writing them *into* the patchy Anthropocene analytic. We focus on three different sites – the field, the stomach, and the soil – to illustrate how these imaginaries work in practice. We explore how regenerative agriculturalists juxtapose these various imaginaries into a 'polymorphic' (Jessop et al., 2008) approach to spatial relations. We show how this allows them to see global issues like climate change and biodiversity loss in the specific farmed landscapes they manage, and to situate the landscapes they manage as part of the solution to those same issues.

In the next section, we provide an overview of the patchy Anthropocene concept. We then introduce geographical literatures on space and scale and weave them into the patchy analytic. In the two following sections, we present the regenerative agricultural movement, and our methods for data capture and analysis. The subsequent three-part analysis

traces the spatial imaginaries at work in the regenerative agricultural model, along with the farm management practices and landscapes they are producing. In conclusion, we reflect on the implications of our analysis for conceiving of the geographies of food production and farm management 'for' the patchy Anthropocene (Maye et al., 2022).

1.1 | The patchy Anthropocene and the plantation

Tsing and colleagues develop the concept of the patchy Anthropocene from analyses of plantation agriculture. They suggest that the plantation model has provided both intellectual inspiration and an economic engine for environmental destruction, ecological simplification, and unequal economic development since taking root, most significantly, in the projects of European empire (Davis et al., 2019). They focus their analysis on the twin processes of what they term 'modular simplification' and 'feral proliferation'. In the former, ecologies are simplified, rationalised, accelerated, and then replicated in the globalisation of the plantation model. In the latter, simplification leads to blowback, generating an unexpected and pathological abundance of pests, endowed with an ability to move along the vectors of globalisation with violent outcomes for the lives they entangle (Giraud et al., 2019). Proliferation is exemplified in a host of plant pathogens, invasive species, and zoonotic diseases that spill over from industrial forests, plantations, and factory farms (Hinchliffe et al., 2016).

Under the plantation rationale, the lives whose growth is indexed to accumulation (like crops and livestock animals) are nurtured, while those with less easily traced financial benefits are killed or removed (Tsing, 2017). The plantation is indivisible from racialised hierarchies of control, accumulation, and labour (Davis et al., 2019) and it produces injurious outcomes for both the other-than-human lives on the plantation and the human communities proximate to it (Chao, 2021). The managerial approach to the plantation has a particular set of spatial characteristics. The spatial extent of the plantation is expanded outwards as the complexity of the relations it contains are reduced, while the hikes in output this rationalisation helps generate spatially separate the periphery (where the socio-ecological harms tied up with intensive cultivation are concentrated) from the core (which enjoys the benefits of accumulation and none of the violence of production) (Wolford, 2021).

Tsing and colleagues argue that the processes of ecological simplification and feral proliferations are tightly coupled within specific landscapes, and that their healthy or harmful outcomes are rooted in place and visited on the more-than-humans who dwell there (Tsing et al., 2019). They call on scholars to pay close attention to the spaces within which simplifications and proliferations unfold. To do this, Tsing and colleagues draw on the science of landscape ecology and the study of landscape structures and the patches of which they are composed. They define a landscape as a 'unit of heterogeneity whose components – at any scale – are patches' (Tsing et al., 2019, p. s188). Landscape structures are aggregations of patches, which are always coming into being, iteratively produced through more-than-human activity. Agricultural landscapes are a perfect example. Although farmers choreograph ecologies of plants, animals, soils, pollinators, and water to produce desired financial and agronomic outcomes, vegetal and animal life just as often as not compromises their control.

They suggest that by learning how to 'read' (Brown, 2019) the complex socio-ecological histories of landscape structures and their constituent patches, along with the harms and benefits they produce, scholars can use individual case study sites as analytical gateways to reflect on their relationships with longer and larger dynamics of change. Such 'arts of noticing' (Tsing, 2015) can help scholars see in synthesis structural macro-scale processes and local, specific, and micro-scale events. This is the aspect of the patchy analytic we are most interested in here: the means and ambition to attend to the specificity of Anthropocene outcomes in relation to the socio-ecological forces actuating the world at much greater spatio-temporal scales.

This ambition is complicated by the very scale of the things being studied. Many of the socio-environmental crises at the heart of the Anthropocene (climate change, biodiversity loss, etc.) are so large and have such a complex set of drivers that they cannot be fully understood in single spatio-temporal contexts. Tsing and colleagues encourage scholars to use models as 'thought experiments' to come to know the character of large-scale socio-ecological changes to cultivate more peaceable ways of living on a damaged planet. They also warn of the siren call of models and the way they can supplant affective engagements with the more-than-human worlds they are designed to apprehend (see Swanson, 2019).

Tsing et al. (2019) are particularly interested in how multiple 'systems as thought experiments' can be juxtaposed to produce competing and/or complementary evaluations of landscape dynamics. They suggest that this approach helps gain more observational and analytical traction on landscape structures with multivalent character and multiple temporalities. They propose focusing on ecological simplifications, feral proliferations, landscape structure, landscape patches,

and systems as thought experiments to grapple with the 'spatial and historical unevenness that hides in plain sight in the Anthropocene' (Tsing et al., 2019, p. s190).

1.2 | An enhanced spatial grammar: vertical, horizontal, and volumetric models

The work of Tsing et al. offers us a good start, but we wager that the project to spatialise the Anthropocene would benefit from a deeper engagement with geographic scholarship on space and scale. The first potential stumbling block, we believe, relates to the risk of naturalising categories that are, in fact, products of social and political construction (Marston et al., 2005). When studying ethnicity and nationhood, for example, if scholars use the 'nation state' as a given category, they risk legitimating nationalist sentiments that they might otherwise be looking to query (Moore, 2008). How can scholars use spatial categories in patchy Anthropocene-inspired work (particularly the landscape patches and structure Tsing and colleagues provide) without privileging their analytic significance, assuming things about their spatial qualities, or 'reifying' their ontological status (MacKinnon, 2011)?

Adam Moore suggests that the root of the issue lies in the 'unreflexive conflation of scale as an everyday category of practice with [the] treatment of scale as a substantial category of analysis' (Moore, 2008, p. 207). That is, a slippage between the usage of spatial units as a set of experience-distant ontological groupings that academics deploy to understand the worlds they are studying (categories of analysis), and their usage as a set of epistemological heuristics that are used by social actors to organise their behaviour and which go on to have material impacts in the world (categories of practice). He argues that confusion with these terms is creating a literature inattentive to the convergence between research design and findings. Using the spatial category of the 'nation state' in critical study will, to return to the above example, produce research attuned to the significance of the nation state, even though notions of nationhood are historically, topographically, and socially contingent.

What does this mean for the patchy Anthropocene and its application in social science research? We argue that it necessitates a commitment to using inductive rather than pre-determined spatial categories. In our study, we allowed the spatial frames used by our participants to emerge through interviews and over successive rounds of inductive, grounded theory style coding (Moghaddam, 2006). We focused on the intellectual activities involved in the construction of spatial categories and the material outcomes produced through the enactment of those frames. This approach forced us, as scholars, to grapple with the epistemological (categories of practice) not ontological (categories of analysis) character of spatial categories in our efforts to spatialise the Anthropocene. The landscape patches and structures in the patchy Anthropocene might be approached with similar analytic caution. They are not pre-determined spatial units – and scholars using the patchy concept need to attend to the reasons why actors divide complex landscapes into constituent patches in the way they do every bit as much as they must attend to the biophysical, morphological, and ecological qualities of the places being studied.

A recognition of the epistemological character of spatial and scalar categories need not entail their wholesale abandonment (cf. Marston et al., 2005). Indeed, the patchy Anthropocene requires a sophisticated conceptual grammar to properly study the uneven spatial distributions of the harms, benefits, and responsibilities of contemporary socio-ecological crisis. In the empirical analysis that follows, we describe three (epistemological) spatial imaginaries that are used in the regenerative model. They include vertically nested systems, horizontally networked connections, and volumetrically deep approaches to space. The character and consequences of these three spatial imaginaries have been described in the literature.

The description offered by Taylor (1982) of vertically nested global, national and city scales has been hugely influential. Grounded in materialist political economy, work using this spatial imaginary has revealed how uneven economic outcomes emerge from the flows and interactions of capital between groupings at different levels in a vertically arranged hierarchy (Smith, 1990). This work initiated thinking on nested scales, in which 'different activities are organized at different scales covering the same places' (Collinge, 2006, p. 244).

Geographical interest has shifted to frameworks of networked horizontal connection. These foreground the linkages that conjoin related activities in distant locations (Collinge, 2006). As Leitner argues: 'whereas the spatiality of a politics of scale is associated with vertical relations among nested territorially defined political entities ... networks span space rather than covering it, transgressing the boundaries that separate and define these political entities' (Leitner, 2004, p. 237). Scholars have been drawn towards such frameworks to account for the connections that have come to define contemporary economic and social life: commodity chains, agricultural supply and demand, labour migration, environmental governance, plastic pollution, governance structures of multinational corporations, and so

on. These vectors traverse the globe, link distant actors, activities, and outcomes, and make complex rhizomatic webs of causal connection.

More recently there has also been a 'volumetric turn' in geography to address concerns over an excessive focus on two-dimensional surfaces (Billé, 2017). This shift is linked to a more general material turn, focusing on the stuff of life which, by its nature, exists across three rather than two spatial dimensions (Steinberg & Peters, 2015). In our study, we go beyond the technocratic gaze that has been 'hard to escape' (Adey, 2013, p. 53) in scholarly accounts of three-dimensional space by documenting the volumetric imaginaries used by non-hegemonic actors to guide their sustainable farm management strategies.

We use the term *spatial* as a catch-all to refer to the manner in which spaces relate to one another, and the way things happen within them. We allow the term to accommodate all of the vertically arranged, horizontally connected, and volumetrically deep framings used in this paper. We append to this the term *imaginary* to emphasise that we are dealing with epistemological (not ontological) heuristics that our research participants use to structure their subjectivities and guide their actions.

Rather than seek out a single spatial theory of everything, Jessop et al. (2008) recommend scholars embrace a polymorphic account of relations that 'emphasizes the importance of contradictions, conflicts, dilemmas, marginalization, exclusion, and volatility, at once within and among each of these sociospatial forms' (2008, p. 394). We agree that such an approach is needed to apprehend complex socio-ecological phenomenon with multivalent spatial connections and manifold temporalities. Such 'planetary social thought' (Clark & Szerszynski, 2020) is needed to situate human activity 'within the story of a planet that is evolving and organizing itself' across timescales and spatial planes, both big and small (Szerszynski, 2022, p. 194). As we discuss in the final section of the paper, this polymorphic spatial approach also has good fit with the conceptual underpinnings and normative ambitions of the patchy Anthropocene, and is a key part of the strategy that allows regenerative practitioners to grapple with global socio-ecological issues through the management of specific farmed landscapes.

1.3 | Regenerative agriculture

Although the notion of agricultural regeneration has been around for some time, its ascent into the food mainstream over the last 10 years has been dizzying. Regenerative agriculture now boasts dedicated agricultural fairs, peer-to-peer learning networks, and consumer-facing food labels. A review of the movement's history and recent emergence is outside the scope of this paper, and so we direct readers to Newton et al. (2020) for a more comprehensive account. In this section, we instead focus on the aspects of regenerative agriculture that have a direct bearing on the way its practitioners conceptualise the spatial aspects of farm management.

The regenerative model is geared towards the revitalisation of the ecosystems on which agricultural production relies, particularly soils (Schreefel et al., 2020). Its key principles are captured in Figure 1. Farmers use 'no-till' techniques (in which seeds are drilled into the topsoil) rather than ploughing, and they keep the soil covered by vegetation with cover or catch crops (plants like vetch and clover that are grown in between arable cash crops that can themselves be grazed by livestock animals). These practices are designed to allow soil structure to develop and complex and functional ecologies to flourish.

Livestock animals play an important – though not ubiquitous (Newton et al., 2020) – part in regenerative soil health strategies (Gosnell et al., 2020). Through their manure and browsing habits, ruminants cycle nutrients around the farm, reduce reliance on synthetic inputs of fertilisers, and create complex, carbon-rich soil ecologies. Livestock integration in Figure 1 refers to the cycling of grazing and cropping land use. The aim being to improve soil health and fertility, and to install diverse agroecosystems of which grazing ruminants are seen to be an important part. The term 'diversity' in Figure 1 relates both to the diversity of agricultural land use and the ecological diversity on the farm more generally. Crop diversification strategies move away from common minimally diverse rotations of wheat, barley, and oilseed rape towards longer and more elaborate rotations including peas, beans, oats, grasses, and fodder crops (Cusworth et al., 2021a, 2021b).

2 | METHODS

The paper draws on 42 interviews with English farmers who identified as being, or in the process of becoming, regenerative. Their farms ranged in size from 80 ha to 10,000 ha. The research sample represents a range of direct to consumer, part-time, and 'hobby farmer' business models, all the way up to large, commercial units that employed several full-time

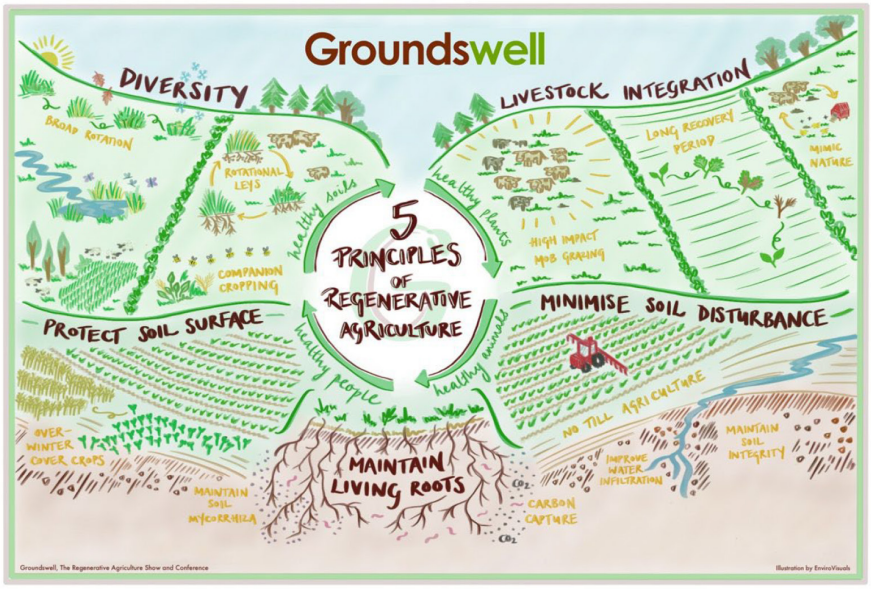

FIGURE 1 The five principles of regenerative agriculture, taken from Groundswell, the organisation that runs the largest annual regenerative agriculture conference in the UK.

staff and who sold their produce through agricultural commodity markets. In addition to these interviews, we also attended four farm events being run by and/or for regenerative farmers, and spoke with experts from various extension services and agricultural research stations. This latter group, who were spoken to late on in the data collection process, added a level of strategic oversight to our findings. We used their expertise to help corroborate the input we had from our farming cohort. Interviews were a mix of 16 telephone and 26 in-person conversations.

Interviews were sourced initially with pre-existing contacts and, thereafter, through snowball sampling. The world of regenerative agriculture is well networked and practitioners were forthcoming with requests for interviews, farm visits, and recommendations for other potential interviewees. Initial contact with participants explained the nature of the research. Follow-up emails provided a more detailed information sheet that had been vetted by the University's ethics board. This specified that the interviews would be recorded and that the participants' words, with permission, might be used in future publications. Virtually all agreed to having their name attached to their words. In response to a small number of requests, we changed the name of a few interviewees for anonymisation purposes.

It is worth noting that the notion of 'regenerative agriculture' is going through a period of rapid growth, change, and differentiation. Many large agri-food businesses, along with policy makers from the FAO, the UK, Europe, and the USA, are weaving regenerative principles into their environmental and agricultural strategies. As a result, its origins as an endogenous farmer-led movement are being complicated by the arrival of powerful political and commercial interests. The version of regenerative agriculture we are documenting here comes from farmers developing and applying regenerative farm practices and advocating for the broader adoption of regenerative principles across the farming community.

We coded our data inductively, following a grounded theory approach to social science research involving successive rounds of coding and analysis (Moghaddam, 2006). The inductive emergence of the spatial imaginaries we describe are central to the way we navigate the risk of 'reifying' spatial and scalar terms that we outlined above. We also use a series of diagrams and photos to represent the regenerative spatial imaginaries we identified. The graphics were developed in collaboration with Vivien Martineau, an artist who works within the world of alternative food networks. The photos were taken by Alexander Turner and permission to use them here was obtained from both the photographer and the individuals captured.

2.1 | The spatial imaginaries of regenerative agriculture

Our analysis explores three spatial imaginaries, which we illustrate with reference to three sites. These sites are central to the practice of regenerative agriculture and we feel are most indicative of the imaginaries we want to convey: (1) the vertically nested scaffolding that links the molecular to the field to the farm; (2) the horizontally networked connections

known through the stomachs of livestock animals; and (3) the volumetric considerations manifest in the regenerative valorisation of soil.

2.2 | Vertically nested scales and agricultural fields

> The real shame of a brown [tilled] field is that it is a chunk of solar energy that is not being harvested by photosynthesis.
>
> Tim May, 1,000 ha mixed livestock arable farming

> If you are growing cover crops you might just as well graze it. Then you are starting that nutrient cycling at a time when you want to be cycling nutrients.
>
> George Hosier, 650 ha mixed livestock arable farming

The production of food is, from the perspective of these regenerative farmers, a relatively simple project. There is the energy that the sun provides, and it is either harvested or not via the process of photosynthesis. There are nutrients that are either incorporated during the plant's growth phase or lost to run off or atmospheric breakdown. The agricultural implications of these biophysical systems must be observed to farm well: crops must be in the ground to harness the sun's energy, and the field must be managed in such a way that nutrients and water are available when they are needed.

Our farmers explained that fields were the smallest modular unit they use to organise their regenerative strategies: 'patches' in patchy Anthropocene parlance that accommodate one particular agricultural land use at any one time, and that are bounded by field margins like rivers, hedgerows, and ditches. They are the sites at which their understandings of the microscopic dynamics of energy, water, and nutrients are put to work. In some instances, diversity within a field is pursued to create synergistic relations between different plant types. The establishment of mixed grazing swards and arable under-sowing, seen in Figure 2, are good examples. More commonly, though, fields are taken as the compositional units out of which heterogeneous farmed landscape structures are assembled. They operate as the focal point in a vertically arranged, nested, spatial imaginary. Standing in a field, farmers can look *down* the hierarchy to reflect on how the foundational biophysical processes involving energy, water, nutrients, and so on drive

FIGURE 2 Field-scale regenerative strategies. Clockwise from top left: mixed sward and sileage bales; soil ecology flourishing under cattle manure; wheat undersown with clover; and legume–grass mixes being measured with a plate metre. Images by Alex Turner.

ecological behaviours and agronomic outcomes. From the field, they can also look *up* to think about the constraints of farm-level regenerative governance: how to run a financially viable unit, how to ensure its agroecological viability in the long term, and how to sustain or improve farm productivity. Per the ecological model of patch dynamics, the level of process (the field) is understood in relation to the level above it (the farm), which provides top-down constraints; while the level below provides the fundamental mechanisms dictating exchanges and outcomes (Wu & Loucks, 1995).

Although we complicate the two-dimensional implications of this imaginary later on, different land uses are applied *onto* and *across* fields as a way of generating farm-scale regenerative strategies that encompass the farm's total areal coverage, while field-level strategies are generated from understandings of relevant microscopic processes. In RA, the principle of *enterprise stacking* functions as a simplified ecological and economic heuristic that can be called on when jumping between the microscopic, field, and farm levels on this vertical hierarchy. The term relates to the way different agricultural ventures can be accommodated in a farm unit and cycled around different fields over time to create a resilient farm business (for discussion on the financial rationale for the adoption of regenerative practices, see Cusworth et al., 2021a; Jaworski et al., 2023) and a diverse agroecological system. This approach allows farmers to scale up knowledge about how water drains through the soils, which crop types give and take particular nutrients from the soil, which suppress or invite specific pests, and which prepare the soil in (dis)advantageous ways for successive crops to produce field-level practice, and from those factors to create a spatio-temporal choreography of farm-scale regenerative management. Figure 3 is the first diagram we developed to capture this vertically arranged microscopic–field–farm imaginary.

Distinctions can already be traced between this spatial imaginary and those that govern the plantation that we encountered earlier. Rather than expanding a simplified and highly productive agroecology over areas of increasing spatial extent, those in the regenerative movement use insights about water, nutrients, and energy to develop management practices that can be applied to their fields, and they assemble those land uses to create regenerative strategies that cover the farm's full territory. This allows them to move away from the chemical inputs used in the plantation model to manage fertility and pests and towards the curation of heterogeneous (farmed) landscape structures composed of individual (field) patches. Soil fertility, water drainage, soil structure, and pest suppression are emergent features of this regenerative agroecological arrangement, rather than things secured through mechanical and/or chemical intervention.

2.3 | Horizontal connections and livestock stomachs

While there are many aspects of the regenerative model that its practitioners conceive of through the above microscopic–field–farm vertical imaginary, there are others that cannot be accounted for in this way. For these, our farmers imagine a horizontal web of causal connection as part of their regenerative strategies. These horizontal imaginaries help map the agro-ethical responsibilities that arise from connections that spill out over the farm gate and exceed the confines of the

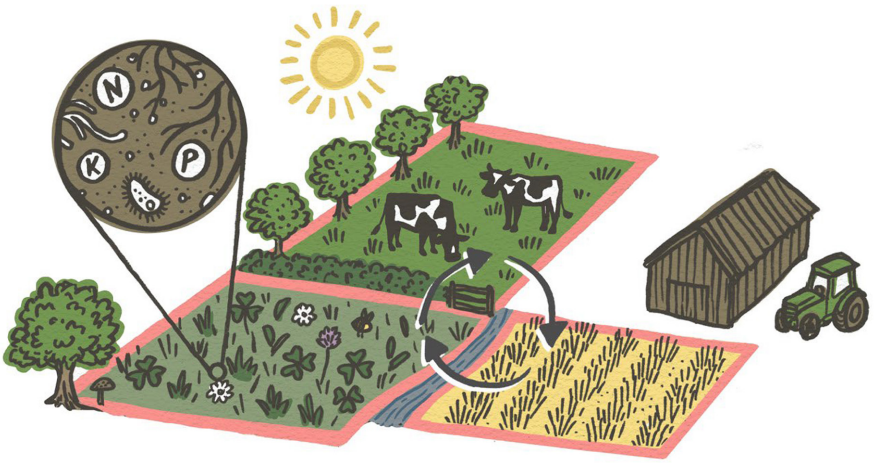

FIGURE 3 Vertically nested regenerative imaginary. By Vivien Martineau.

farm (Cusworth, 2023). The stomachs of livestock animals are one important site through which these horizontal linkages are thought through.

Regenerative practitioners distinguish their grazing strategies (whereby animals consume only grass and locally produced fodder) from intensive livestock husbandry practices (in which the animals eat feed products made of soya and other high-protein compounds grown around the world). They are enthusiastic about the positive roles that ruminant animals (like cattle and sheep) can play in a sustainable food system compared to chickens and pigs. This is because ruminants can graze on grass, hay, sileage, cover crops grown in between cash crop rotations (used for arable–livestock integration) and other fodder crops like beets, beans, and peas. Monogastric systems, on the other hand, are overwhelmingly reliant on high-protein compound feed products. As one farmer put it:

> Pork and chicken is fed from a globalised food system, bringing in artificial maize, soya, grains, with nutrient-rich, polluting manure coming out at the other end … that's not really going to work in the years to come. The ruminant that's grazing and pooing where they are … that's the system that is going to work.
>
> George Hosier, 650 ha mixed livestock arable farming

Such invocations illustrate how animal rumens are sites through which the farm's horizontal connections to, and responsibilities for, distant landscapes are made knowable, affecting, and actionable. Crops grown for animal feed are having profound and negative impacts, particularly in the Amazon and Cerrado forests (Barona et al., 2010) where land is being converted to monocrop soya plantation. Regenerative 'pasture-based' livestock systems are being developed to combat these land use change dynamics by renouncing the supply chains underpinning them. This boutique feed supply chain reveals efforts being made in the regenerative movement to think through relationships between husbandry practices in one patch of the world and deforestation and land use change in others. Such global trade connections are classic examples of horizontally networked spatial connections (Yao et al., 2018). Their linkages traverse the bounded regional and national units provided in vertically nested scalar frameworks, and instead focus on those vectors linking causes with remote outcomes (Leitner, 2004).

Overwintering is a good example of how reflections about distant horizontal spatial relations, made corporeal via the digestive activities of livestock animals, are propelling the development of new farm management practices. While most livestock farmers in the UK will graze their animals outdoors over the summer to some extent, virtually all rely on important feed products to get them through the winter. As such, particular efforts need to be made to ensure that animals can survive exclusively on locally grown feeds the year round. Figure 4 is an image of a parkland field being prepared for a winter of outdoor grazing. It has been marked out on GIS software into equal cells, each of which has been populated with four hay bales. Over the course of the winter, the cows will be moved between the cells (created through temporary fencing infrastructures), eating the fresh sugary grass first, before moving onto the hay when it runs out.

The regenerative preference for locally grown feed represents a spatial intervention through which the horizontal connections conjoining the UK livestock sector with the Amazon rainforest are being renegotiated, and even severed entirely. Although these strategies clearly have their own verticality (dividing a large area of parkland into smaller blocs and applying practices onto a field's and farm's areal coverage), the regenerative desire to install them is configured by a horizontal imaginary of spatial relations: one equipped to account for the vectors of globalised supply chains, and the

FIGURE 4 Field containing bales of hay to overwinter cattle. Image by Alex Turner.

political economic forces driving deleterious land use in distant parts of the world. The rationale for the adoption of such practices is, of course, always part driven by concerns about the financial costliness of expensive feed products (with one dairy farmer interviewee, Dan Burdett, explaining that 'There are years when yield is king. But a lot of years when costs are very high and you have to keep them down. So, you know, profit is everything'). Nevertheless, across our data and across the literature on the topic, engagement with global environmental issues such as deforestation is a remarkably consistent feature of the regenerative psyche (Jaworski et al., 2023).

Figure 5 is the second of our spatial diagrams and shows how remote causal connections are folded into regenerative farm management.

Efforts to act on the injurious socio-ecological implications of participating in animal feed supply chains represent an important departure from the spatiality of the plantation model. In the plantation, it is only those ecological processes (crop growth, animal reproduction, etc.) that produce financial value that are taken into account. Here, farms are being managed with respect to outcomes that do not have implications for the running of the farm business or socio-ecological outcomes that will be experienced in or near to the landscapes being managed.

2.4 | Volumetric thinking and agricultural soils

Regenerative practitioners situate their soils as part of a global land use system that could, if properly orchestrated, make a substantial contribution to warming mitigation. As one farmer suggested:

> Of all the different ways that we can avoid catastrophic planet change, by far the easiest and cheapest way is by looking after the soil on a worldwide level.
>
> John Cherry, 1,000 ha mixed livestock arable farming and organiser of the Groundswell regenerative agriculture show

There is a complex spatial imaginary at work here. Carbon dioxide emissions, wherever they originate, contribute to the global atmospheric stock. They are the ultimate fungible environmental pollutant (Cooper, 2015). As the polluting and offsetting activities of actors on opposite sides of the globe add or subtract to an aggregate stock of greenhouse gas emissions and radiative forcing, climate change can be thought of as being toggled to the topmost level of a vertical hierarchy that links the emissions of individual farms to the regions, to nations, and finally to the whole world. Regenerative farmers, in this way, frame their farms as the compositional units through which climate mitigation efforts can be enacted.

To deliver on this promise, however, farmers think *volumetrically* about their soils. They reflect on the ecological interactions that lead to additional organic matter being stored in the soil's three-dimensional coverage, and the process through which soil builds deeper into the earth. As one farmer explained:

> What if we are getting an extra millimetre of soil a year? I know there's a level where we might get stuck at, I don't know, 12% organic matter, but we are seeing another millimetre, two millimetres of soil. So it's soil mass and depth too. This farm is on a gentle slope and that soil was being washed off … we're

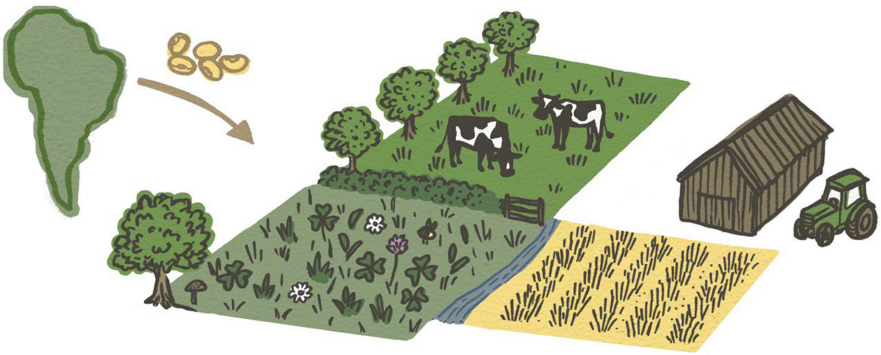

FIGURE 5 Horizontally networked spatial imaginary. By Vivien Martineau.

> rebuilding it back up gently and slowly. And let's add that into the tonnage of carbon [for emissions accounting purposes].
>
> Jonty Brunyee, regenerative agriculture educator and researcher

Several regenerative practices are used to build soil structure, organic content, and depth. Our participants commonly see the most important step being to minimise or stop tillage. Doing so removes the disturbing effects of soil cultivation and reduces exposure to erosion (which represents the *loss* of soil depth) and atmospheric interaction (in which the nutrients in the soil are released as gases). No-till is usually done in conjunction with establishment of undersown or cover crops, which ensure the soil is covered at all times, even after an arable crop has been harvested. By keeping soils covered, and by keeping living roots in the ground over the entirety of the agricultural calendar, regenerative farmers are working to build healthy soils, whose nutrient and carbon content is less exposed to breakdown, and whose depth is less subject to the eroding effects of the wind and rain.

For these same soil-health reasons, regenerative farmers also consider the depth that different plant roots tap. Regenerative farmers collocate plants with longer root systems with plants whose roots tap much shallower, allowing them to access the nutrients stored in different strata of soil depth without competing with one another. This helps the farmers get the most out of the soil's finite supply of nutrients. Deep tapping root systems are illustrated in the chart in Figure 6 (which we found to be ubiquitous in the offices of regenerative farmers). They are valued for how they help the soil system build deeper into the earth. Deep-tapping roots pierce the earth under the soil, and introduce the moisture and biology needed to turn it into humus. This effectively increases the volume into which regenerative farmers can enhance their carbon, nutrient and water reserves: techniques that are central to the carbon farming ambitions of the regenerative model (Schreefel et al., 2020).

Among our interviewees, there were conflicting perspectives about how this soil carbon sequestration story should (or should not) interface with the running of the farm business. While some were excited at the prospect of monetising their stored carbon in the form of emission offsets, others were more hesitant:

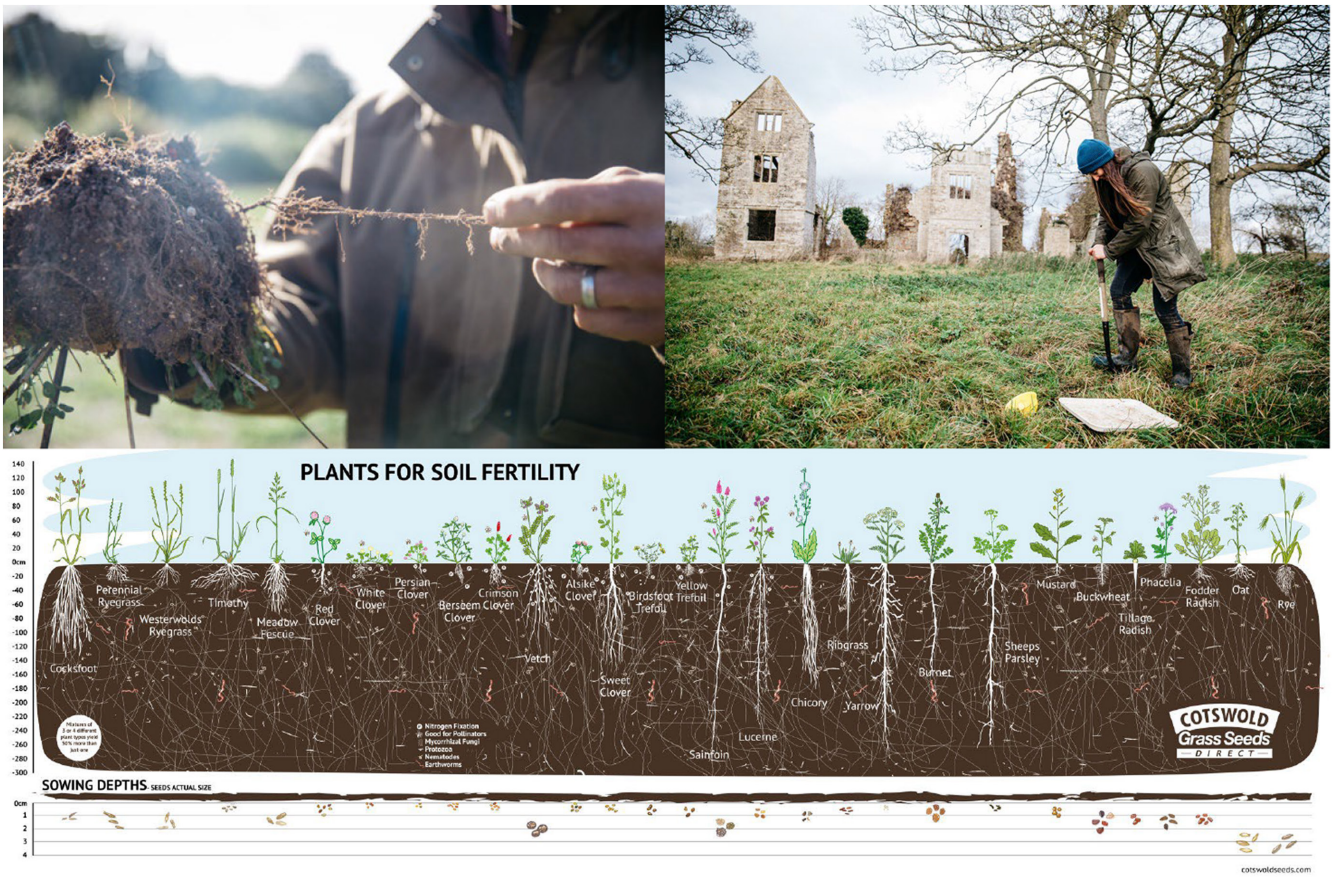

FIGURE 6 Volumetric soils. Clockwise from top left: deep tapping legume roots with nodules of nitrogen; soil testing in action; graph showing the depth of different root systems. Photos by Alex Turner, graph produced by Cotswold Seeds.

> I don't trust any of them to be honest. I almost signed up and I started thinking well, if I was the person buying the carbon credit I would want to know where that carbon is, how much of it there is and I would want proof of it. And I don't think anyone can actually do that yet.
>
> Andy Howarth arable farmer managing 300 ha

What is consistent however, across both our data and the literature, is the regenerative focus on soil health (Jaworski et al., 2023). Such efforts to increase soil depth and improve its carbon content, ecological complexity, water retention, structure, and fertility represent a spatial departure from the plantation model. In intensive conventional farming, soils are seen as little more than a substrate within which crops are grown. Key nutrients are added to ensure crop growth, and pesticides are used to manage disease and weeds. In the regenerative model, by contrast, soil is regarded as lively, complex, and agential. Its good health demands the minimisation of soil disturbance, the reduction of pesticides, and the presence of diverse vegetation. Multispecies entanglements do not just inhabit soil's volume in this understanding, they *are* soil's volume (Krzywoszynska & Marchesi, 2020). The differences in these models is not so much a distinction between the spaces identified as areas of concern (both arrive at the soil as a site necessitating active management) but rather the strategies different farmers use with regards to these spaces. Figure 7 is our diagrammatic representation of this volumetric engagement.

2.5 | Farming for the patchy Anthropocene

What can these farmers contribute to the ongoing academic efforts to spatialise the Anthropocene? What can they teach us about the benefits of rejecting the plantation model of agricultural land management in favour of productive farmed landscapes that enable multispecies resurgence (Tsing et al., 2017)?

Figure 8 is an amalgamation of the three images we have used to illustrate our three spatial imaginaries of nested vertical scales and fields, horizontal connections and rumens, and depth and soil. It shows how multiple spatial imaginaries are overlaid and juxtaposed in the regenerative mindscape. While not exhaustive, it conveys how the regenerative model enacted by our research participants is premised on a 'polymorphic' (Jessop et al., 2008) approach to spatial relations.

Tsing and colleagues place great value on how the juxtaposition of multiple systems-as-thought-experiments gains analytic traction on the emplaced yet ubiquitous character of the patchy Anthropocene. Although they present their discussion in relation to the overlaying of different models of political economy, non-secular cosmology, and ecology, the above hybrid regenerative spatial imaginary also fits the bill. Take the regenerative engagement with the issue of climate change and warming mitigation. While volumetric concerns (how deep does soil go, how much carbon is stored in its three-dimensional coverage) get to the very heart of regenerative agriculturalists' climate mitigation agenda (Schreefel et al., 2020), they are always enacted *through* and *for* other spatial considerations. The desire to make use of the soil's carbon offsetting potential is, for example, underpinned by a framing that grapples with a globalised sink of emissions and offsets and an associated set of diffuse climactic outcomes. Regenerative contributions to emissions offsetting, although inherently volumetric in their nature, are achieved by applying regenerative

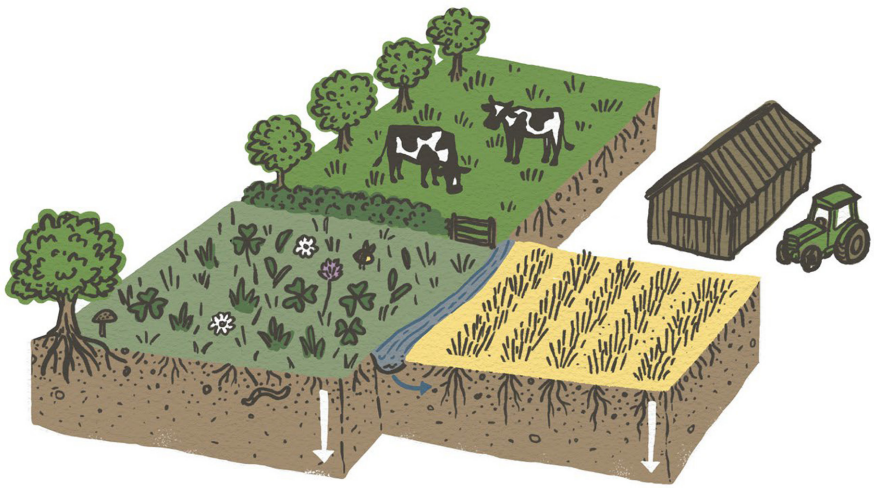

FIGURE 7 Volumetrically deep spatial imaginary. By Vivien Martineau.

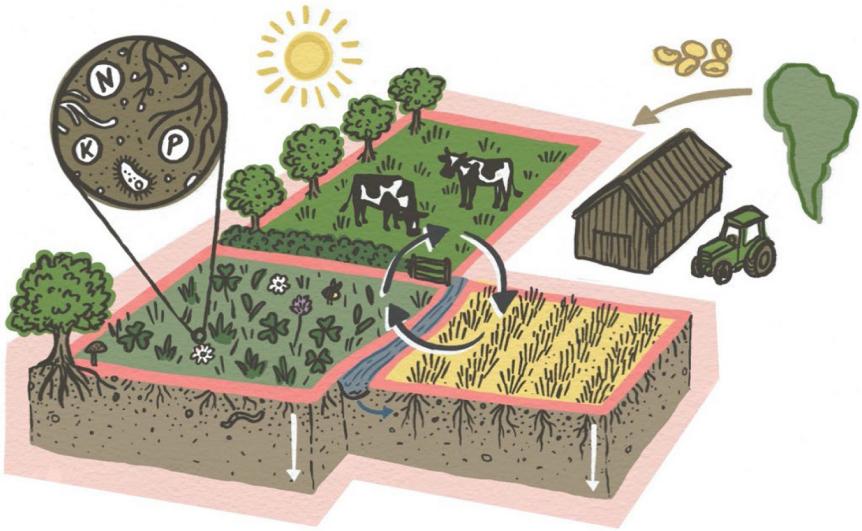

FIGURE 8 The polymorphic regenerative spatial imaginary. By Vivien Martineau.

practices onto the areal coverage of the farm and its constituent fields. The practices of no-till, cover cropping, livestock–arable integration, and crop diversification, which are all designed to build soil depth and increase its carbon content, are effectively applied onto the land as if it were a flat two-dimensional cartographic area. As discussed above, these practices are predicated on a conceptualisation of the farm as a set of vertically nested spaces, in which field-level practices, which are informed by understandings of microscopic processes relating to water, nutrients, and energy, are assembled into farm-scale strategies.

The same proclivity for juxtaposing and overlaying is at work in regenerative efforts to build soil depth and the ecologies and fertility contained in its volume. These ambitions are designed to reduce the holding's financial overheads of pesticide and fertiliser inputs, limit the farm's contribution to water pollution (which happens when excess fertiliser is applied to the land such that it runs off into local waterways), and to sever its connections with energy-intensive synthetic fertiliser production systems. These concerns each have their own set of spatial characteristics. Farms are joined (or not) to fertiliser production facilities through international horizontal supply chains, and they are situated in a vertically arranged nested system connecting their farms to landscape and local and regional water-pollution levels. Regenerative farmers seek to act on these concerns through volumetrically engaged strategies: building fertility and ecological complexity *downwards* to recast the nature of their relations *outwards*.

The soils, stomachs, and fields at the heart of this study are artefacts that allow 'scholars and their subjects to move simultaneously through deep time and human time, through geological space and political space' (Hecht, 2018, p. 135). In patchy Anthropocene parlance, through the juxtaposition of multiple systems-as-thought-experiments, regenerative farmers situate the specifics of individual landscape patches in the landscape structures they form, and those in macro-scale dynamics of land use change, biodiversity loss, and global warming. The regenerative spatial imaginaries described in this paper allow managerial and ethical traffic to flow between particular spaces and socio-ecological issues of global consequence (Cusworth, 2023). This, we believe, is an enactment of planetary social thinking (Clark & Szerszynski, 2020) and an integral part of a model of food production 'for' the patchy Anthropocene (Maye et al., 2022).

ACKNOWLEDGEMENTS

This research was funded by the Wellcome Trust, Our Planet Our Health (Livestock, Environment and People - LEAP), award number 205212/Z/16/Z. For the purpose of open access, the author has applied a CC BY public copyright licence to any Author Accepted Manuscript version arising from this submission. The funding body played no part in the study design; in the collection, analysis, and interpretation of data; in the writing of the report; nor in the decision to submit the article for publication. I would also like to thank the editorial team and the anonymous reviewers for their input into the paper.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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How to cite this article: Cusworth, G., Lorimer, J. & Welden, E. A. (2024) Farming for the patchy Anthropocene: The spatial imaginaries of regenerative agriculture. *The Geographical Journal*, 190, e12558. Available from: https://doi.org/10.1111/geoj.12558