AUGUST 2024

WHAT IS REGENERATIVE AGRICULTURE?

This piece is a summary of the TABLE Explainer What is Regenerative Agriculture? *and aims to define the concept and illuminate key debates. Citations and references for the information discussed below can be found in the full explainer.*

Regenerative agriculture is concerned not just with creating agricultural systems that 'do less harm', or that are merely 'sustainable', but that somehow 'restore' or 'regenerate' natural ecological functions. However, it remains a fluid concept, without an agreed formal definition, and proponents have many different perspectives as to what it is or ought to be.

Defining regenerative agriculture

Definitions of regenerative agriculture cluster into three (overlapping) kinds. There are those that emphasise specific *practices*; those that focus on desired *outcomes*; and those that envision a new way of relating to one another and the natural world – a regenerative *mindset*.

Regenerative agriculture as a set of practices

Most people referring to regenerative agriculture will include in their description of associated practices some mix of the following principles that inform farm practices: (1) limiting soil disturbance; (2) maintaining soil cover; (3) fostering agricultural diversity; (4) keeping living roots in the soil; and (5) integrating livestock and arable systems (Cherry, 2020). These are briefly summarised in the box below. Sometimes a sixth is added: 'Understand your context.' This one is cross cutting and underlines the point that regenerative agriculture entails a close attentiveness to the agroecological, social and other specifics of the farm, with practices and goals adjusted accordingly.

Cover image: Alexander Turner

Included in this summary

TABLE

A key goal within regenerative agriculture is the maintenance of soil fertility and its wider 'health'. Soil fertility refers to the capacity of soil to support crop growth and is primarily described in terms of levels of specific nutrients (nitrogen, phosphorus, etc). Meanwhile, soil health relates to more diffuse ideas like the importance of natural cycles, high levels of biodiversity, and its ability to deliver ecosystem services. Soil health is maintained in several ways.

Principles and associate practices associated with regenerative agriculture

Objective	Associated methods	Proposed benefits
Maintain soil cover.	• Avoiding overgrazing so that sufficient plant residues remain to enable regrowth. • Mob grazing and pasture rest periods to allow build-up of decomposing plant residues on soil surface. • Retain arable crop residues on soil surface. • Plant overwinter cover crops between sowings. • Undersow or intercrop with companion crops like legumes.	• Reduces fluctuations in soil temperature and moisture content to benefit the soil microbial community. • Increases plant residue and (at least in the short term) carbon inputs to the soil. • Leguminous companion crops fix nitrogen into the soil and so limit fertiliser use. • Cover cropping improves soil microbial abundance and so fertility, nutrient content, and soil organic content by 15-41%.
Limit mechanical disturbance of the soil.	• Avoid compaction of soil by farm machinery. • Minimal or reduced tillage (limited cultivation of soil surface through ploughing before sowing seeds). • Zero tillage or direct drilling (sow seeds directly into uncultivated soil).	• Reduced soil erosion. • Improved soil structure and water drainage. • Potentially increased soil organic carbon content (as discussed later, this is heavily contested).
Limit chemical disturbance of the soil.	• Reduce synthetic pesticide (herbicide, fungicide, insecticide) and fertiliser usage.	• Promotes the soil microbial community and soil biodiversity. • Avoids downstream environmental impacts like water pollution, biodiversity loss, and high greenhouse gas emissions.
Keep living roots in the soil.	• Integrating overwinter cover crops into arable rotations. • Resting pasture with sufficient residual heights rather than overgrazing.	• Increases soil carbon inputs and sequestration. • Increases nutrient availability. • Greater aeration, drainage, and water infiltration.

Another aim of regenerative agriculture is to promote biodiversity and shift away from highly simplified monocultural systems. Benefits of so doing can include pest suppression, reduced reliance on chemical inputs and improved soil fertility, with soil health arising as an emergent feature of the system. These benefits can be advanced through:

- Diversification of crops grown in an arable rotation, particularly including legumes.
- Diversification of cover crop or pasture seed mixes.

- Promotion of biodiversity on land spared for non-agricultural purposes by planting hedgerows, sowing wildflowers, etc.
- Shifting to polyculture systems such as those associated with agroecology.

Regenerative agriculture also looks to crop-livestock integration to promote environmental benefits. This integration can be achieved in a variety of ways, such as by including forage crops in an arable rotation, or grazing livestock on temporary grass-based leys to increase soil carbon stocks in an otherwise arable system. However, these measures may reduce crop yields so the environmental risks of compensatory cultivation or stocking with 'additional' livestock (and associated emissions from ruminant enteric fermentation) must be mitigated. See "What is feed-food competition?" for more detail.

Regenerative agriculture as a set of outcomes

Rather than focusing on practices, some define regenerative agriculture based on its intended outcomes. Specifically, they emphasise aiming for agroecosystem (particularly soil) restoration and empowering farmers to achieve this goal using context-specific approaches. For example, farmers may employ practices (e.g., soil tillage) usually discouraged in the regenerative model if they nevertheless achieve regenerative outcomes (*it's not the plough, it's the how*).

To achieve these goals environmental metrics would be required as proxies for ecosystem and soil health to give farmers, commercial and political actors a robust and legally-defensible evidence-base for regenerative outcomes. Debate remains over which metrics provide the required information in a way that is cost- and time-effective but empirical tools (like the Global Farm Metric and Soilmentor) are emerging to fulfil this need. Metrics may also include social outcomes such as better mental health and greater profitability for farmers.

Regenerative agriculture as a mindset

Viewed as a mindset, regenerative agriculture focuses more on attitudes about the relationship between humans and the non-human world than about specific farming practices. This creates an adaptive, generative, and open-ended sense of regeneration. Here, regeneration is understood as an ongoing *journey* – a continuously evolving process of experimentation taking place within interconnected ecological systems. This mindset also places value not only on scientific knowledge but also with spiritual and emotional engagement with a farmed landscape. Whilst this perspective lacks the robust definitions needed by purely commercial and political actors, many consider a mindset approach essential for achieving more expansive social objectives. These may include promoting farmer-consumer interaction, farmer mental health, rural economy resilience, and a redistribution of power in the food system.

Is a consensus definition needed?

The lack of a clear definition may be the very reason regenerative agriculture has catalysed such diverse ideas for food system transformation from such a wide variety of actors. Rather than competing, the differing articulations could constitute different *tiers* on the same regenerative framework. A tiered framework may encourage actors starting on the regenerative journey (with practices) to go on to engage more with wider psychological, ecological, and political ambitions.

A 'broad church' approach that welcomes various actors (from radical elements to corporate actors) and accepts overlap with other approaches (permaculture, organics, agroecology) would allow a highly adaptive form of regenerative agriculture. For example, in the right context, farmers could remove central planks of the movement (like no-till management), and their farms would remain 'regenerative'. Here, a *family resemblance* definition may be required: a cluster of practices and principles can be considered integral to regenerative agriculture, but none of which is, unto itself, a necessary condition.

Regenerative agriculture as a set of actors

Along with the inherent fluidity in its definition(s) there is disagreement over which actors *are* or *should* be involved in regenerative agriculture. Since its inception in the 1980s, regenerative agriculture has been led by a network of participating farmers and researchers sharing and learning from one another's successes and failures. Meanwhile, against the backdrop of political and commercial imperatives to offset carbon, promote

biodiversity, and deliver net-zero, the movement has drawn attention from large commercial actors (General Mills, Danone, Nestlé and more).

The potential conflict between these two groups of actors raises questions over regenerative agriculture's more politically radical goals. For example, the practitioner-led incarnation of the movement emphasises small-scale farming, local food systems, and the removal of chemical inputs, which implies redistribution of power in the food system. Corporate actors however are likely to focus on using the regenerative model to make marginal reductions in their environmental footprint, rather than to critique their own privileged place in the food system. Some argue that involving these actors is beneficial because it leads to accreditation schemes (e.g., the global Ecological Outcome Verification) which can remunerate participating farmers. Yet many regenerative agriculture proponents, particularly farmers, are wary of large agri-businesses altering or removing those aspects of the model less amenable to corporate dilution, accreditation and greenwash.

Regenerative agriculture: knowledge practices

The regenerative mindset critiques the knowledge practices of 'conventional' farm management as reductive, stating that complex agroecosystems cannot be fully *known* through discrete metrics. For example, mainstream farm management mostly understands soil quality as the function of levels of nitrogen (N), phosphorus (P), and potassium (K). Meanwhile, regenerative practitioners may view healthy and productive soils as a living and complex *whole* including interactions between mycelium networks, nutrients, water, carbon, worms, beetles, crop roots and so on. This holistic understanding informs soil management practices, like reduced tillage and preserving living root systems, which provide soils the time and ecological complexity to maintain health and viability rather than just 'topping up' fertility with synthetic inputs. However, as concepts like soil health become mainstream, these differences may be becoming less about recognising complexity and more about how actors seek to alter that complexity.

The argument for some in the regenerative movement is that whilst metrics provide some insight, they are only a partial proxy for the whole. Thus, practitioners seek to attune themselves to their farmed environments in more visceral, instinctive, emotional, and even spiritual ways to gain a more holistic understanding. From this vantage point, tools like the Global Farm Metric and Soilmentor may help farmers achieve regenerative outcomes but cannot substitute for attentiveness and experience. Moreover, some advocates voice doubts over whether scientific study can ever fully quantify the impacts of regenerative farming. For example, where scientific studies have failed to associate regenerative grazing with long-term carbon sequestration, advocates have claimed these studies did not properly represent the complex and adaptive methods of regenerative livestock management. Disputes about scientific research (dis) proving the impacts of regenerative practice can be condensed into two questions: *what counts as knowledge*, and *whose knowledge counts?* Trust is an important factor here, implying greater engagement between the scientific and practitioner communities (as is starting to happen) is required to promote knowledge sharing.

Regenerative agriculture and food system change

Some regenerative agriculture advocates argue for radical changes to the food system. They focus on social regeneration and foodscapes characterised by local supply chains, seasonality, cottage industries, and ultimately more employment opportunities and higher wages for famers. This suggests dietary shifts to less processed, more local food and a redistribution of power within the food system away from large corporate interests and to a diversity of smaller actors. In this articulation, corporate actors have little place in a regenerative future.

There are debates over whether productivity is maintained under regenerative practices and how much results vary according to crop type, farm systems, soil type and bioregion. Giving a categorical answer is difficult given definitional ambiguities. Nevertheless, a coherent vision for avoiding excessive land-use change resulting from potential productivity decreases is required (see 'What is the land sparing-sharing continuum?').

The role of livestock in regenerative agriculture is another point of contention, particularly because of the links between greenhouse gas emissions and biodiversity loss and the livestock sector. Whilst some argue that unlike

intensive livestock production, regenerative systems actively benefit rather than harm the environment, others argue the exact opposite. There are also concerns that regenerative agriculture is problematically unengaged with the outsized environmental impacts of animal products. This links to discussions around *less and better* meat: regenerative agriculture focuses on *better* livestock management, but this might distract from efforts to eat *less* meat in the Global North. Some hesitate to endorse lowering meat consumption worrying that it will stigmatise animal products from regenerative agriculture, which they argue are part of the solution. But some worry that in a globalised market-dominated food system without focussing on *less*, as well as *better*, the desired environmental benefits will not be achieved. For example, it remains unclear how companies with product portfolios heavily dependent on meat and/or dairy will approach issues of consumption. For detailed discussion of these debates see the Meat, metrics, and mindsets TABLE explainer.

The science and uncertainties

Whilst scientific studies have analysed practices associated with regenerative agriculture in terms of yield and environmental impact, results are highly dependent on location, methods, and the inherent variability and 'noise' of farmed landscapes. Thus, whilst research does provide useful insight any results should be treated with caution. Obviously, this section represents only a small fraction of the research in this area (see this review and others for more detail) and the evidence bases are constantly growing.

Some evidence suggests that no-tillage practices can decrease GHG emissions by up to 19% relative to conventional tillage. However, they can also *increase* them by up to 20% due to soil carbon and nitrogen fluctuations. This averages out to reduced emissions of 7.6%. There are also downsides to no-tillage like increased nitrous oxide emissions in waterlogged conditions and weed build up.

There is also debate over the environmental impacts of livestock. For example, studies have shown that regenerative grazing systems can store 13% more carbon and, per unit-area of land, lead to 66% lower emissions than conventional grazing. However, when emissions are measured per unit-food produced such systems may not perform as well as so-called efficient conventional systems in terms of emissions (see 'What is environmental efficiency and is it sustainable?').

The offsetting potential presented by soil carbon sequestration is contentious, especially given the commercial and political interest it attracts. There is confusion about the depth at which soil carbon gains should be assessed. For example, no-tillage may simply redistribute carbon in the soil: Luo *et al.* (2010) conclude that no-tillage management increases soil organic carbon content up to 10cm of depth, but reduces it from 10-40cm, leading to no overall change in carbon content. Moreover, organic inputs (cover cropping, manure) have been shown to play a greater role in soil carbon gains than tillage practices per se.

In these cases, and other similar ones, there is disagreement about *whether* and *how* regenerative agriculture can be legible to empirical inquiry given its context-specific and holistic nature. For example, there is considerable contestation about whether standardised scientific trials fully capture the ecological benefits of regenerative rotational grazing systems where practitioners must adapt and respond to changing weather, grass growth, and animal eating behaviours.

Conclusion

Despite at least some agreement on its overarching principles, regenerative agriculture lacks a formal definition and as such reflects a diverse range of views. The aim of this piece has been to explore the various meanings of regenerative agriculture for different actors using the term and their visions for the future of the food system. Some think regenerative agriculture simply reflects more environmentally conscious on-farm practices, whilst others promote a more radical vision where regenerative agriculture leads to a whole new way of thinking about food systems and the wider natural world.

The full report (with associated citations and references) is available at:
https://www.tabledebates.org/building-blocks/what-is-regenerative-agriculture