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The futures for regenerative agriculture: insights from the organic movement and the tussle with industrial agriculture

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Concern has been raised about the potential greenwashing/co-optation of regenerative agriculture (RA) due to a lack of consensus on its definition. While the academic literature has cataloged various approaches to defining RA, each definitional approach carries with it a relative concern for its likelihood for co-optation and the potential transformative power it can have within the sector. As the industrial agrifoods sector is taking interest in the field, lessons from the organic movement are worth highlighting. The corporate system has easily integrated the foundational pillar of growing food without chemicals, but left behind the pillars of alternative food distribution, and a focus on whole foods and unprocessed ingredients. Corporate interest in RA could be a major driver for scaled adaptation, yet it may lose its focus on the regeneration of agriculture resources, ecosystems functions, and the social systems required to reproduce the next generation of farmers. The greatest challenge is that the fundamental concern is a philosophical one, which entails a shift in how humans perceive the natural world and their role in it. As RA scales, will it hold to its values and remain obscure, or could its values merge with the predominant industrial system to have significance and affect real change in agriculture?

KEYWORDS

organic agriculture, regenerative agriculture, organic certification, cooptation, definition

1 Introduction

As the global population continues to grow, the challenge of feeding humanity without devouring the planet in the process is further illuminated as food demand may increase 60% by 2050 (Rhodes, 2017; Husaini, 2021). This concern is further exacerbated by climate change, which introduces weather variability and misaligns crop genetics with increasingly variable conditions (Husaini and Sohail, 2018). Adding to this, natural resources paramount to agriculture such as soils, aquafers, and food related terrestrial biodiversity are either degraded and/or overexploited (Husaini, 2021). 30% of the planets crop land has been lost to degradation and desertification, and 52% is either facing moderate or severe soil degradation (Rhodes, 2017). "*…we are destroying the productivity of the same soil from which we demand a relentless increase in production*" (Rhodes, 2017) (p. 123). Multiple agricultural approaches have been developed since the 1940's aimed at shifting agricultural production away from eroding/destroying the environment and the resource base fundamental to farming. These practices include natural farming, permaculture, organic agriculture (OA), agroecology, and conservation agriculture (Rhodes, 2017). Fundamental to these alternatives is limiting or reversing the negative impacts to the environment and ultimately farming in a manner that

improves the environment. Essentially, these alternatives seek interactions with nature that regenerate its resource base rather than deplete/degenerate them, raising sustainability concerns.

Taken a layer deeper, some of these alternatives fundamentally question humanity's relationship with the natural world and its role in it. In the western knowledge perspective, this is a question that has ever been present within the juxtaposed ideas of Descartes and Spinoza. Is our quest as humans on the planet to learn and understand the world in order to master it and reshape it to serve our needs, or is our quest as humans to understand the world to meet our needs while operating within its principles (Grober and Cunningham, 2012)? Fundamental to many of these agriculture alternatives is a shift in humanity's relationship with nature to relinquish the idea on mastery over nature and embrace a more than human ethic of care, embracing notions of reciprocity where non-human life and entities are equally cared for in our interactions with the natural world (Seymour and Connelly, 2023; Sands et al., 2023).

One of the most successful of these alternatives to conventional agriculture is OA, whose roots date back to the late 1800's in response to increased soil degradation, poor quality crops, plant diseases, and increased pest attacks after the introduction of chemical fertilizers and pesticides (Leu, 2020; Kirchmann et al., 2008; Barton, 2018). Critics argued synthetic substances were an unnatural way to grow food and there were centuries of long proven approaches (Kirchmann et al., 2008). Paramount contributors to this movement include Rudolf Steiner (1861–1925), Sir Albert Howard (1873–1947), and Lady Eve Balfour (1898–1990). The first known use of the word organic in reference to this form of agriculture appears in "Look to the Land," authored by Walter Northbourne in 1940 (Heckman, 2006). The modern organic movement is largely based on the ideas forwarded by Howard, which include returning organic matter to the soil through composting, using pests as indicators of poorly functioning systems, and taking a holistic rather than reductionist view of food production (Heckman, 2006; Youngberg and DeMuth, 2013; Pollan, 2006). Howard's writings and work with J.I. Rodale strongly influenced the birth of OA in the US, which had its roots in the late 1960's counterculture.

Today "organic" is a household term though there maybe incongruence between its perception (organic agriculture) and organic certification (standards set by certification bodies). Globally, OA as a movement is steered by the International Federation of Organic Agriculture Movements (IFOAM) which was established in 1972. IFOAM plays an active role in promoting global adoption, setting standards, and advocating for policy changes for OA (Kirchmann et al., 2008; About Us | IFOAM, 2024). IFOAM principles for OA are health, ecology, fairness and care. Organic certification on the other hand is a process regulated by governments and at its minimum is largely focused on growing foods without the use of synthetic chemicals (Leu, 2020; Lorenz and Lal, 2023; Tscharntke et al., 2021). OA is the only agricultural system whose management practices are codified by law in many countries (Lorenz and Lal, 2023). While there are many organic certification bodies whose standards go beyond the minimum government requirement, better reflecting the IFOAM principles, this is not necessarily true for organic foods meeting the government regulations. As such, there can be inconsistency between the realities of OA and organic certification because the certification does not necessarily reflect OA principles. Nonetheless, ideologically OA is oriented toward using natural modulating processes to grow food (Zimmermann et al., 2021).

In 2022 global sales of organic foods reached 135 billion euros (US$ 146 billion) (Willer et al., 2024). This reflects the steady increases seen in the global sector over the decades. Between 1999 and 2013, the global sector saw a fivefold increase to US$72 billion (Reganold and Wachter, 2016). As of 2022, 188 countries have organic activities, 75 have fully implemented organic regulations and 14 drafting them (Willer et al., 2024). Data from the Organics International survey show continual increases in land conversion to OA globally, with a 4.1% increase between 2019 and 2022. 2% of the world's agricultural land is dedicated to organic production with 50% found in Australia (Lorenz and Lal, 2023; Willer et al., 2024). OA is expected to expand further with the EU targeting 25% within the territory by 2030 (Lorenz and Lal, 2023). OA is linked to many benefits relative to conventional agriculture which include ecosystem services, biodiversity, soil quality, reduced pesticide residues, reduced water pollution, and increased profitability (Reganold and Wachter, 2016). At the same time, OA has drawbacks which include a yield reduction of up to 25%, increased land use, and higher food costs (Lorenz and Lal, 2023; Reganold and Wachter, 2016). It is argued that universal organic farming will only be able to feed approximately 4 billion people and reduce biodiversity due to the lower productivity, thus making it unsustainable in the long run (Husaini and Sohail, 2018; Husaini and Sohail, 2023). In an era of increased food inflation and climate change, higher costs put downward pressure on demand for organic food.

An approach that has received a lot of attention recently and has been called the new buzz word is regenerative agriculture (RA). RA first appeared in the late 1970's but came into wider circulation after being adopted by the US-based Rodale Institute in the early 1980's with an aim of going beyond sustainable (Leu, 2020; Giller et al., 2021). Robert Rodale defined RA with the following description:

> *"one that, at increasing levels of productivity, increases our land and soil biological production base. It has a high level of built-in economic and biological stability. It has minimal to no impact on the environment beyond the farm or field boundaries. It produces foodstuffs free from biocides. It provides for the productive contribution of increasingly large numbers of people during a transition to minimal reliance on non-renewable resources."* (Giller et al., 2021) (p. 14).

The occurrence of RA in the literature was sparsely employed until the end of the 1990s and lost interest from the first of the 2000s while still being used by the Rodale Institute. In 2016, it regained popularity among farmers, NGOs, multinational companies, and charitable foundations in the USA and Australia as an opportunity to move toward sustainability (Giller et al., 2021; Wilson et al., 2022). Scientific research has also gradually turned its attention to the phenomenon. Newton et al. (2020), observed a growing interest in RA, but also an absence of a proposed compelling widely adopted definition.

The growing popularity of RA today, reflects a continuing quest among farmers, environmentalists and conservationists to realize an approach to agriculture that lives up to the ideal of not "negatively" affecting the environment and even if possible, enhancing it. To this end, RA is in numerous ways linked to fighting climate change and advancing the United Nations sustainable development goals (SDG's)

(Rhodes, 2017; Sands et al., 2023; Newton et al., 2020; Schreefel et al., 2020; Gordon et al., 2023). RA's principles which include minimal soil disturbance, maximize crop diversity, keeping the soil covered, and maintaining living roots, all help build soil carbon which sequesters carbon dioxide from the atmosphere. These agricultural principles when implemented make positive impacts of SDG's 2 (zero hunger), 13 (climate action), and 15 (life on land). A reality that remains true is that for wide scale adoption of an alternative approach, it needs to align with the mainstream economic system. Where alignment does not exist, compromise enables integration with the aspects that are most easily integrated with the current institutional system, with least policy resistances.

Concern exists that RA could be subverted by corporate interests reflected in the terms co-optation or greenwashing where the original intent is subverted or misleading claims about environmental benefits are made (Gordon et al., 2022; de Freitas Netto et al., 2020), diminishing the value of the concept (Newton et al., 2020). RA has a vulnerability due to a lack of consensus in defining it, which makes it ripe for co-optation or being stripped of its truly transformative aspects (Gordon et al., 2023; Bless et al., 2023). In this void, certain actors have stepped in to forward their own agendas using the principles of RA (Bless et al., 2023; Tittonell et al., 2022). Moreover, the organic movement from the United States in the late 1960's synonymous with the counterculture movement, highlights how the combination of widescale adoption and assimilation with industrial production, resulted in two transformative pillars of the movement being abandoned, which in many cases was central to why the movement started in the first place.

In this article, we first highlight different definition approaches to RA within the academic literature to define RA and highlight each approach's propensity for co-optation and potential transformative power. Following this, we discuss the pillars present within the organic movement during the 1960's counterculture movement and how only one of those pillars is still part of the mainstream/industrial system. We then highlight the trend of many large agri-food corporations establishing their own RA standards. Finally, we discern how this will likely reproduce a scenario where only those aspects most easily integrated into the predominant economic system will become what RA is about from a mainstream perspective, allowing it to have more relevance in transforming the agricultural sector.

2 Lack of a standardized definition for RA

Many authors have highlighted the lack of a consensus regarding a definition of RA as a threat to the movement and forward various arguments to support their concerns. The first consists of the impossibility of clear and effective communication between researchers and practitioners to study the claims and impacts of RA adoption (Newton et al., 2020). The second consists of the risk of co-optation and/or greenwashing by corporations and farmers, misleading investors and consumers about their practices, products, or services (Gordon et al., 2023; Al-Kaisi and Lal, 2020; Page and Witt, 2022). The third challenge lies in the fact that an absence of a clear definition of RA hampers public action. Not only is this important to promote publicly funded research and extension of RA (Newton et al., 2020), but it is also necessary to incentivize efficient adoption of the practices.

Based on the literature, we identified four definition approaches to RA as seen in Figure 1. Broadly, the approaches are split into two categories, technical (blue boxes) and social (yellow boxes). These

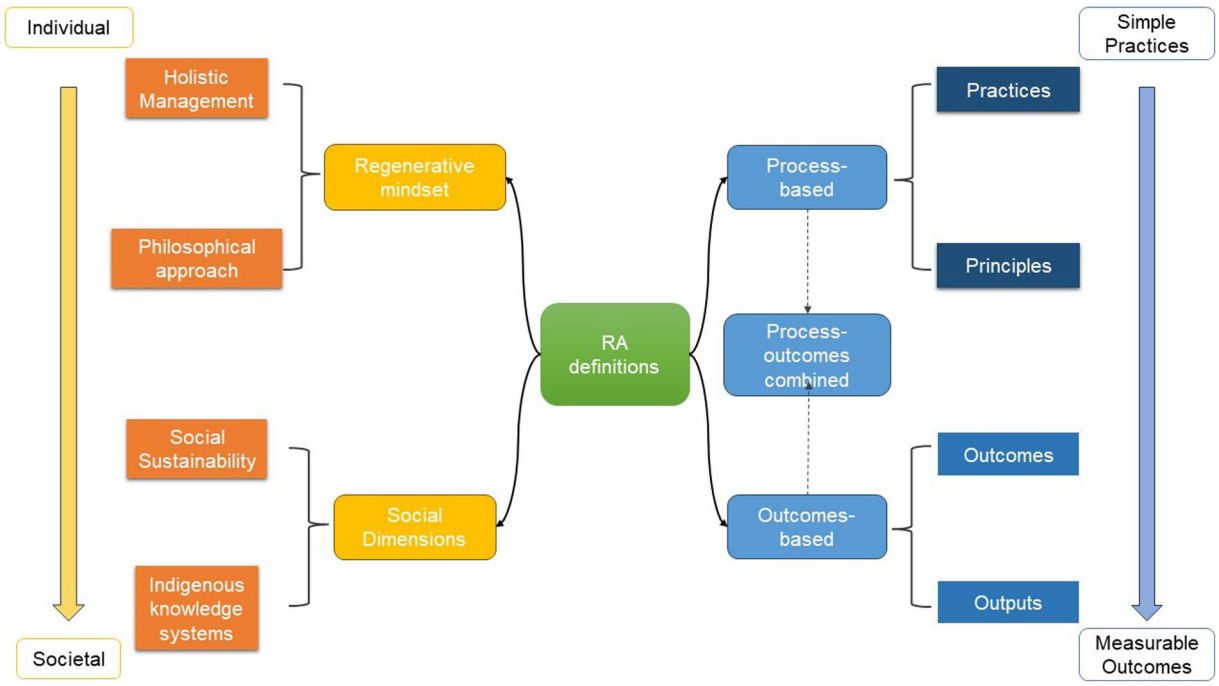

FIGURE 1
Approaches to defining regenerative agriculture found in the literature.

technical categories further breakdown into process and outcome-based definitions, exhibiting a gradient that goes from relatively simple practices to measurable outcomes. Similarly, the social category further breaks down into categories of philosophical and social dimensions, exhibiting a gradient going from the individual level to the societal level. While the graphic represents these as distinct definition approaches, they are by no means exclusive.

Alternatively, arguments have been made regarding the utility of not employing a single definition of RA due to strategic, political, or conceptual reasons. Additionally, a single definition is likely to curtail the ability for the movement to evolve within various social contexts to address particular challenges as the term regenerative itself is not bound with notions of finality (Soloviev and Landua, 2016) (p. 5).

2.1 Regenerative agriculture as process-based definitions

Process-based definitions describe RA as a "myriad" of combinations of practices and/or principles (LaCanne and Lundgren, 2018). As such, the principles/practices are generic, independent, and can be applied where appropriate (Tittonell et al., 2022). Common principles include minimizing soil disturbance; keeping the soil covered year-round; keeping live plants; keeping roots in the soil for as long as possible; incorporating biodiversity; and integrating animals (Sands et al., 2023; Brown, 2018).

Alternatively, definitions can also be based on farming practices as "minimize tillage"; "stubble retention"; "diverse crop rotations"; "multispecies cover crops," "intercropping"; "composting and use biostimulants," "rotational grazing," "reduce synthetics inputs" (Khangura et al., 2023) (p. 3). Additionally, other definitions are more prescriptive, giving technical checklists with barred activities such as "abandon tillage" and "eliminate pesticide use" (LaCanne and Lundgren, 2018) (p. 2–5). Describing RA only regarding particular practices/principles could lead to agnosticism as the outcomes are not scientifically verified (Newton et al., 2020).

2.2 Regenerative agriculture as focusing on the outcomes

RA outcomes is another definition approach where focus is placed on measurable results rather than practices (Newton et al., 2020). According to Wilson et al. RA's outcomes refer to three categories: "Climate Adaptation and Mitigation," "Socioeconomic benefits" and "Integrated systems" (Wilson et al., 2022) (p. 1). RA plays an important role in climate adaptation as outcomes related to increased biodiversity, increased soil carbon, and retaining organic matter help increase resilience to crop losses due to suboptimal growing conditions (pests, poor weather, companion planting), biologically driven nutrient availability for plants, and increased soil moisture holding capacity and nutrient cycling, respectively. Regenerative agriculture's outcomes are deeply linked with carbon farming (or conservation agriculture) to regenerate the soil by sequestering carbon from the atmosphere and build soil carbon (Gordon et al., 2023). Carbon farming additionally helps fight climate change as soils are a major sink of carbon on the planet and help regulate the carbon cycle (Lal, 2013).

Often, "outputs" and "outcomes" are confused in the descriptions. Outputs are more specific in a context. They refer to an "immediate" result of practices, while outcomes represent the "overall" durability value created by those outputs (Saifi, 2023). For example, sequestered carbon or increased crop yield. On the contrary, outcomes are beneficial for the farm system production but also for "the common good" and they represent the "final goal" sought around different agroecosystems (Wilson et al., 2022).

2.3 Combined process and outcomes-based or outputs?

In this type of definition, there is a link between the implementation of particular processes in order to achieve specific outcomes (Newton et al., 2020) but it depends on the starting conditions of degradation, soil, climate, and production system on each farm (Tittonell et al., 2022). As such, it is important that practitioners have strong evidence linking the process to the outcome and ensuring that in almost all situations, the expected outcome from the process will occur. As Newton et al. (2020) note, across time, there may be a disconnect between a practice and an intended outcome as conditions change or given the baseline characteristics of the soil. For example, how the amount of carbon is stored differs regarding soil types. Clay soils can store much more carbon than sandy soils and the rate of annual increase of carbon in the soil is temporary (Giller et al., 2021).

Finally, Gordon et al. (2023) explains that this type of definition reduced to processes or outcomes excludes the non-quantifiable aspects of a regenerative mindset as others consider RA to be a socio-ecological approach (Brown et al., 2021).

2.4 Regenerative as a mindset

Some authors argue RA is a socio-ecological approach and as such, define it from a philosophical/regenerative mindset perspective where RA is a holistic or system based approach (Wilson et al., 2022). The holistic system approach refers to continual improvements in environmental, social, economic, and spiritual wellbeing through innovations on the farm (Alliance, Regenerative Organic, 2018). This approach mimics natural systems for enhancing on-farm ecosystem functions by prioritizing soil health and biodiversity, which simultaneously can improve social and economic factors (e.g., wellbeing, profits, and food security) (Page and Witt, 2022).

Farmers are seen to step back from each part of the farm's ecosystems to see a whole where practitioners are described as using the full landscape of the farm to assess its clear holistic goals from an ecological perspective (Gordon et al., 2023). They analyze life cycle assessments to understand the ecosystem processes on the farm (Soloviev and Landua, 2016). As such, they use ecological interactions and the local spatial variability of the farm (Gosnell et al., 2019) to define a suite of planning procedures described as planned grazing, land planning, financial planning, and ecological monitoring (Savory Institute Holistic Management, 2023).

From a holistic management point of view, farmers can choose different tools adapted to their holistic context to reach regenerative

outcomes. The question is not about whether should we ban this practice, but more how we use this tool? In this case, the use of fertilizers or tillage is neither good nor bad, it depends on the context (Gordon et al., 2023).

2.5 Social dimensions

A more recent definition approach in the literature is to define RA in a manner that acknowledges the knowledge systems from which these practices come from, which is traditional and indigenous cultures (Sands et al., 2023; Gordon et al., 2023; Bless et al., 2023). Authors such as Sands et al. (2023) note that current regenerative practices are largely found in pre-colonial knowledge systems around the world including the Americas, Africa, and many parts of Asia.

A major hurdle of these knowledge systems being acknowledged from a western perspective is their "entanglement" with non-material aspects, which include spirituality, values, cultural beliefs and reciprocity, which for the Indigenous group in question are inseparable from the agricultural practices (Sands et al., 2023). From a Western perspective, these non-material facets are viewed as mythical distractions from the essential/utilitarian aspects in question (Gould et al., 2020). While disconnecting the practices from their Indigenous origins may appear to be objective/rational/scientific, in reality this act means that "…regenerative principles and practices are in fact re-embedded in an entirely different socio-cultural context, that of Western science and capitalism" (Sands et al., 2023) (p. 1704) – in essence, appropriating them from Indigenous ways of knowing into Western scientific perspectives.

Another definition approach to RA focuses on the need to incorporate social and political concerns to address the social aspects of sustainability, i.e., equity, diversity, health, democracy and, quality of life. As highlighted in the previous sections, all other definition approaches largely deal with agronomic practises that deal with economy and the environment, but do not adequately address social systems fundamental to agriculture (Gordon et al., 2022). As Tittonell et al. (2022) note, farmers are in precarious situations financially, and the sector is struggling to reproduce the next generation of farmers. Producers today carry more debt, have tighter margins, face more precarious weather (Tittonell et al., 2022), and the financialization of farmland functions as a barrier of entry for new farmers, making it difficult to service the higher debt payments with already squeezed margins (Aske, 2022). Furthermore, the rural communities and livelihoods that enable farming communities to thrive have been eroding, while the industries around them such as seed, chemical, machinery, and finance companies thrive on their backs (Tittonell et al., 2022; Furey et al., 2016; Daghagh Yazd et al., 2019; Hagen et al., 2021). Addressing these concerns faced by farmers, requires more than just a focus on agronomic practices (Tittonell et al., 2022).

Additionally, politics, power, and equity are sorely absent from these prior definitions and discussion of RA (Gordon et al., 2023; Tittonell et al., 2022). Tittonell et al. (2022) note that seeking to change widescale agricultural practices without engaging the political system appears neutral, in line with neo-liberal perspectives, but under appreciates the vital role policy can play in fostering wide-scale adoption.

3 An analysis of historical trajectories of the organic movement

Today, mainstream global certification of organic agriculture is largely focused on agronomic practices that grow food without the use of synthetic chemicals (Leu, 2020; Lorenz and Lal, 2023; Tscharntke et al., 2021). This focus on agronomic practices is a minimum standard that enables the trade of organic products across national and international jurisdictions. While organic agriculture goes beyond the mere exclusion of practices and chemicals, and includes concerns such as care, fairness, ecology and health as articulated by IFOAM (Leu, 2020; Kirchmann et al., 2008), this article deals with the mainstream organic certification.

Looking back into the history and philosophical perspectives underpinning what created the organic movement, it is clear that it encompassed more than just agronomic practices and included concerns of equity, animal welfare, ecology, and health of individuals (Heckman, 2006). Looking at the counterculture of the 1970's in the United States, what remains of the organic movement today is a far cry from what galvanized that movement. Paul Hepperly (retired Research Director, Rodale Institute) argues that, "the meaning of organic farming as an agricultural production system is ever more easily confused with the related but separate areas of organic food and organic certification" (Leu, 2020) (p. 30). As noted above, mainstream organic certification such as that of the USDA focus on what chemicals and practices must be excluded from production (Lorenz and Lal, 2023; Tscharntke et al., 2021). OA, however, has continued to evolve with IFOAM releasing organic 3.0 in 2013. As noted by Hepperly, organic food and certification reflect the lobbying interests of agribusiness and not small independent producers who drove the movement (Leu, 2020).

3.1 Pillars of the counterculture organic movement

While the counterculture movement of the 1960's and 70's largely focused on movement away from materialism and embrace of community, an important contribution of this movement was the advances and establishment of an organic food production sector in the US (Leu, 2020; Pollan, 2006). As many hippies moved away from industrial/capitalist livelihoods, they sought to produce their own foods in a manner that was in harmony with natural principles and did not use synthetic chemicals that were responsible for untold amounts of environmental harm as documented by Rachel Carlson in her 1962 book, *"Silent Spring."* As documented by Pollan (Pollan, 2006), many of these hippies who went back to the land did not come from farming backgrounds and as such, were developing their approach to organic farming through trial and error, mostly error. Important reference material for these producers was the Organic Gardening Magazine which was published by J.I. Rodale (founding member of IFOAM). The magazine saw increased circulation in the late 1970's. Many converts to the counterculture subscribed in great numbers and employed the principles and directions outlined to realize their vision of an alternative way to produce, distribute, and consume food. This back to the land movement was based on three pillars: 1; growing food without harsh chemicals; 2, alternative distribution of food (food co-ops and a local food system); and 3, a

counter cuisine (a focus on whole foods and unprocessed ingredients) (Pollan, 2006).

Pollan describes the movements principles as follows:

> *Acting on the ecological premise that everything's connected to everything else, the early organic movement sought to establish not just an alternative mode of production (the chemical-free farms), but an alternative system of distribution (the anticapitalist food co-ops), and even an alternative mode of consumption (the "counter cuisine"). These were the three struts on which organic's revolutionary program stood; since ecology taught "you can never do only one thing," what you ate was inseparable from how it was grown and how it reached your table."* (Pollan, 2006) (p. 143)

As highlighted by Pollan's 3 pillars ("struts"), the movement at its inception was focused on a lot more than just growing food without chemicals. As such, food co-ops and communes were important distribution mechanisms that allowed all members of their communities to access food with a focus on consumers knowing who grew it (Leu, 2020). The pillar focusing on the counter cuisine embraced the notion of consuming whole grains and unprocessed organic ingredients. This was largely in opposition to foods that were highly processed and made with additives of which "white bread" was seen as a poster child.

3.2 Co-optation by the industrial system

The organic movement appears to have won the battle against the early resistance it faced at its inception. Today, organic products can easily be found in grocery stores, consumers recognize and perceive organic as being good for the planet, and the organic label has been embraced by agribusiness with major companies such as General Mills carrying organic brands. Despite initial resistance and hostility from regulators -who saw OA as ideologically driven and inefficient (Reganold and Wachter, 2016) - the USDA came round later, writing standards for the sector in 1990 following the Alar scare in1989 (Youngberg and DeMuth, 2013). What has been the cost of this victory for the organic sector? In many ways, the organic sector closely resembles the industrial/capitalist system the counterculture was attempting to overthrow with large levels of consolidation as the sector is dominated by large brands. Regarding mainstream organic, the cost of this victory relative to the ideals of the counterculture hippies was the abandonment of the counter cuisine and alternative distribution pillars.

Today the only pillar remaining is that of alternative food production, which is largely focused on growing foods without chemicals. Some would argue even this pillar has been relatively compromised with the use of nature derived substances that are broad spectrum and non-targeted to particular organisms (Lorenz and Lal, 2023). Examples of these include pyrethrin and azadirachtin that are used as insecticides and copper-sulfate -a heavy metal known to have negative effects on invertebrates- used as a fungicide (Lorenz and Lal, 2023; Wiggins and Nandwani, 2020). Additionally, OA producers source certified nutrients originating from conventional agriculture including animal manures, meat and blood meal, organic fertilizers, and straw (Lorenz and Lal, 2023; Sadras et al., 2020). On the abandonment of the counter cuisine and distribution pillars, Khan a successful pioneer of the counterculture on organic production states, "everything eventually morphs into the way the world is" (Pollan, 2006) (p. 152). If this is the case now, how did the movement get co-opted?

Consumer interest in organic products has often mirrored negative news about health concerns/scares related to the agricultural sector. One such scare that galvanized interest in the organic sector was the Alar scare of the 1980's, where the Environmental Protection Agency declared the widely used orchard plant growth regulator a carcinogen (Youngberg and DeMuth, 2013; Pollan, 2006). Consumer interest in organic food surged and organic producers found themselves under pressure to satisfy this demand and the industry used debt to inject needed capital to scale. However, as the health concerns from chemicals disappeared from the headlines so did the increased demand, which left many of these organic operations over leveraged. Amidst the fallout, several operations were bought out or consolidated (Leu, 2020; Pollan, 2006). Following the Alar scare, the organic sector saw a resurgence as several major food companies either created or acquired organic brands, reflecting a determined interest among mainstream brands to participate in this fledgling industry.

Following this growth and interest from mainstream players, federal recognition of the sector followed with the passing of the Organic Food and Production Act (OFPA) in 1990, which established nationwide uniform standards for organic farming, designating a definition to a word that meant diverse things to different people (Leu, 2020; Heckman, 2006; Pollan, 2006). The process of landing on a definition though, turned out to be long and arduous as different groups lobbied for their interests. Industrial actors wanted the standards as low as possible to allow them easy entry into the market, while members of the organic movement wanted to term to mean something and ensure it aligned with organic principles. In a win for the principles of the organic movement, the initial standards put forward in 1997 faced severe backlash from organic farmers and consumers arguing the standards were too lenient and did not clearly and effectively demarcate organic philosophies. The USDA returned to the drawing board and with the National Organic Program in 2000 (Leu, 2020) with a set of standards that better aligned with the principles of alternative food growing systems, particularly rejecting the use of genetically modified organisms, irradiation, and use of sewage sludge (Pollan, 2006).

While the movement won the initial battle on the establishment of standards for alternative growing systems (growing without chemicals), the pillar on establishing a counter cuisine fell during the internal debate within the USDA on whether synthetics and food additives could be part of processed organic foods. The original OFPA from 1990 prohibited the use of synthetics and food additives in organic food. This aligned with the values of the counter cuisine and its proponents raised questions as to whether the organic sector should mirror the industrial system, or should it create something better based on the notion of whole foods. The other side argued that if the consumer wanted organic processed foods, the sector should provide them. Pollan quotes Khan stating, "organic is not your mother" (Pollan, 2006) (p. 156). Proponents of additives and

synthetics in organic food won, adding a list of permissible additives, knocking down the counter cuisine pillar.

Once consumers started demanding organic foods in grocery stores and the industrial sector entered into organics, the pillar of alternative distribution was already impacted. Even for adherents to the organic movements, that notion of alternative distribution channels could never subvert the mainstream food system replacing it with food co-ops. As major food brands either created their own organic brands or bought existing ones, the alternative distribution pillar was likely the easiest to fall. Many decades later, focus on the local food systems is still a point of discussion but is by no means more likely to be realized for the mainstream system (Heckman, 2006).

4 Options for the future of RA

There are many parallels that can be seen between RA, which today is still fledgling, and the organic sector in the US that was inspired by the counterculture movement. The nonlinear trajectory described above shows that there is always a scope for modification in light of newer developments and economic interests. Similar to RA today, where there is no consensus on a definition, organic prior to the 1990 OFPA did not have a settled definition as the term meant different things to different actors and this persists (Lorenz and Lal, 2023). While the eventual definition the USDA landed on did advance relative improvement of the environment based on the elimination of certain chemicals, the movement was stripped of its philosophical values relative to the consumers impression of what the term means. Pollan (2006) refers to organic as, "*a venerable ideal hollowed out, reduced to a sentimental conceit…*" (p. 158). Today, IFOAM continues to face pressure to further adjust is principles on OA and incorporate technologies such as genetic modification to increase agricultural sustainability in line with the UN SDG's. Authors such as Husaini and Sohail (2023) advocate for "organically-grown GM produce" which would merge improved genetics in light of climate change with ecological production practices associated with OA (p. 41).

The mainstream organic certification USDA Organic are standards that have been reduced to growing food without "certain chemicals" which is a far cry from the pillars that were central to the early days of the movement. Put another way, the aspects of the movement that were most easily incorporated into the industrial system is what the mainstream minimum standards are today. While this is true, there still are many benefits realized by OA even if it does not reflect the original ideals. OA today exhibits measurable benefits in the reduced synthetics entering the food systems that negatively affect different life forms, it has reduced water pollution, increased biodiversity, and made farming more profitable for producers among other things (Tscharntke et al., 2021; Reganold and Wachter, 2016). Important to note though, this increased profitability is predicated on wealthy consumers in countries such as the USA, France, and Germany which is driving organic production in poor countries (Husaini and Sohail, 2023). Though compromised relative to its ideals, OA is relevant and as such, has the ability to influence the agricultural sector.

4.1 Option 1: process based approaches

Looking back at this history, it is easy to see how a similar occurrence could take place with RA where there is no consensus on a definition. The process-based definitions are the most vulnerable to co-optation as they are the simplest and enable producers to implement practices without necessarily changing how they think or approach their operation. Process-based definitions allow producers to follow the letter of the law and check boxes while simultaneously violating its spirit. This trait lends itself well to integrating with industrial capitalism as the demarcation line between RA and conventional is blurry. While many principles and approaches can align in spirit, for example using cover crops, terms such as "minimize" in reference to tillage and pesticides in certain situations makes it almost impossible to differentiate RA from conventional. In many cases, conventional agriculture is adopting the language of RA without fundamentally changing its practices, such as the use of biocides or GMOs (Giller et al., 2021; Rempelos et al., 2023; Schätti, 2024; What Is Regenerative Agriculture? | Syngenta Group, 2024). The opportunity to capitalize on merging of new-knowledge/technology with age-old practices within the context of climate change and an increasing population remains unclear. (Husaini, 2021; Husaini and Sohail, 2023). Process based approaches would easily integrate with the mainstream/industrial sector.

A parallel pathway within process based approaches is with what Tittonell et al. (2022) calls "corporate RA," where large multinational companies can engage with RA without the need to address social concerns such as power relations, injustice, and inequality. Big food companies such as General Mills, Cargill, Danone, and Walmart have developed incentive programs for RA aimed at limiting carbon emissions in the agricultural supply chain where farmers are paid for carbon offsets by putting in place RA practices. These types of programs have been described as maintaining the "industrial-globalized landscape" (Gordon et al., 2022) (p. 818). For example, Cargill would like to advance regenerative practices across 10 million acres (Cargil Regenerative Agriculture | Cargill, 2024). However, one important question is about how the companies are measuring these outputs (Koman et al., 2021), and how they report the effects of such initiative in financial and extra-financial performance. The concept of "double materiality" describes how corporate information is worth both for its implications about a company's financial value, and about its impact on humans, animals, and ecosystems health. This brings environmental impacts into the focus of standard-setting in accounting. The background supporting double materiality arises from a recognition that a firm's impact on the world beyond finance can be material, and therefore worth disclosing. Same can be pursued with social justice, through the adoption of ESG frameworks.

4.2 Option 2: outcome-based approaches

Outcome-based definition approaches for RA have the potential to be transformative, making RA the outcome rather than the process/practice. From this perspective, whether an operation is regenerative is based on what measurable aspects of the system are being regenerated. In this regard, assessment is not based on intention or espoused beliefs, but results. As was the case with the counterculture

organic movement, the ability for this approach to not be co-opted will depend on the details regarding indicators and what the thresholds are. Who will determine the set of indicators, what will the thresholds be, and whose interests will be represented? In the case of OA, IFOAM was unable to maintain universal regulation of standards. The government eventually stepped in and created minimum standard that eroded some of the founding principles. Outcome-based approaches are additionally important for measuring and quantifying services of regenerative systems as they are crucial to give trust to the public and fair compensation for farmers. Pertinent indicators of regenerative systems need to be defined regarding the local environmental and social stakes of the regions considered (Wilson et al., 2022).

Scientific indicators are important to support the contextual evidence of the link between processes and outcomes (Tittonell et al., 2022). If the government does not step in to regulate RA by law, third party regenerative certification will play this role. While there are multiple certification organizations, the most popular and oldest today in the US is regenerative organic certification (ROC) developed by the Rodale Institute. ROC is a holistic agriculture certification encompassing stringent standards for soil health, animal welfare, and social fairness. To achieve ROC, producers must first secure USDA Organic certification or an international equivalent, ensuring the exclusion of synthetic inputs and genetically modified organisms (GMOs). Subsequently, they can attain Bronze, Silver, or Gold ROC levels, reflecting the extent of regenerative practices applied across their productive land, evaluated across three critical modules. This progressive certification system not only promotes ecological balance but also supports the wellbeing of farmers and their communities (Regenerative Organic Alliance Framework for Regenerative Organic Certification: Pilot Version Program, 2019). Beyond ROC other regenerative certification programs include Demeter USA, A Greener World, RegenScore, and Soil Regen among others. Given the geographical variance in agricultural biomes, it is a possibility that certification bodies will peg outcomes to regional/contextual factors.

4.3 Option 3: social and philosophical approaches

Social and philosophical-based definitions of RA are also potentially transformative, delving into underlying mental frameworks, values, and relational dynamics that shape behavior. At its core, RA challenges the western conceptualization of humanity's relationship to nature as articulated by Descartes where humans appoint themselves as masters of nature and reorder the world to meet their own needs (Grober and Cunningham, 2012). Instead, RA calls for humans to forge a relationship with the natural world built on the premise of reciprocity and a more than human ethic of care as is best exemplified by Indigenous and philosophical approaches to defining RA. These perspectives on defining RA highlight the relational values between land and human practices, and between values/beliefs and practices (Seymour and Connelly, 2023; Sands et al., 2023). This requires an acknowledgement of the importance of life in all its forms, taking a holistic approach to support the health of the overall system rather than a reductionist approach that targets manipulation of limited variables. Informed by perspectives of reciprocity, the agricultural products are derived from the abundance of the healthy functioning of the system rather than the degrading of the primary resource base. A critique levied against RA is that its goals to regenerate environmental/agri-ecosystems cannot be achieved unless the entire system becomes regenerative (Gordon et al., 2022). In this regard, Indigenous perspectives can be instrumental in helping to thread a narrative between values and practices based on the need for humanity to reconsider its relationship with nature.

Another transformational value of social approaches to defining RA lie in focusing attention on addressing human systems that RA interacts with and operates within, going beyond agronomic practices. As noted above, social dimensions around farming threaten the long-term sustainability of the sector. Addressing critiques from authors such as Gordon et al. (2022, 2023) who note that RA's main focus on agronomic concerns only act to reinforce injustice as expressed through agricultural systems and fail to address the pressures producers and marginalized groups face.

While the social and philosophical definition approaches to RA are the potentially most transformative, they are the most challenging to merge with the mainstream industrial approach to capitalism. Notions of redefining humans' relationship to the natural world, addressing social inequities and discrimination, and wading into politics conflicts with neoliberal norms in western societies. In light of this reality, process and outcome-based approaches are more amenable to the status quo, but it is important to consider the overall system and what it is that RA adherents are attempting to regenerate. If the goal is no deeper than incorporating a few new practices and does not change outlooks or world views, we may end up with a system that takes in regenerative food, but overall remains degenerative, as practitioners focus on the "letter of the law" rather than its spirit.

5 Conclusion

RA has clearly struck a chord with a significant segment of society as it has received so much attention and growth in the last decade. On the surface this strikes as odd, as there is no agreement on what the term specifically means. Rather than it exclusively being about how appealing the concept is, it may equally be about the realization of the precarious state the planet is in. The promise of RA give's people hope that there are options for solving impending environmental crises and relate with the environment in approaches that are mutually beneficial. However, looking at how the organic movement evolved, the ability for RA to solve problems on a large scale will be based on its ability to become mainstream and integrate with capitalism. One alternative is that RA will be stripped of its truly transformational qualities echoing Khan as he stated, "everything eventually morphs into the way the world is" (Pollan, 2006) (p. 152). Another alternative could be that Spinoza's philosophies on humanity and its renegotiated relationship with the natural world based on reciprocity transform society and with-it capitalism. This would make way for humanity to acquire its food from the abundance of regenerated ecosystems and landscapes. Will RA hold to its principles and remain relatively obscure but interesting, or will RA compromise some of its ideals to be relevant?

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Author contributions

TM: Conceptualization, Investigation, Writing – original draft, Writing – review & editing. GL: Supervision, Writing – review & editing.

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The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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