



# Complementing or co-opting? Applying an integrative framework to assess the transformative capacity of approaches that make use of the term agroecology

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## ABSTRACT

The paper discusses the increasing use of the term agroecology in scientific literature and how its meanings vary in different contexts. However, the key issue is not the different understandings of agroecology per se, but whether various interpretations align with its intrinsic systemic and transformative meaning. To address this, the paper presents an integrative framework to assess approaches that use the term agroecology, and distinguish between its enabling and disabling interpretations. The framework is applied to yield- and non-yield-oriented approaches (sustainable intensification, conservation agriculture, organic farming and regenerative farming), revealing concerns of hijacking or co-opting through (1) simplification, (2) false equivalence and (3) confusion. To prevent and/or respond to the – not necessarily intentional – process of neutralization of the transformative potential of agroecology, we propose a combination of accountability and regulatory efforts, education and collaboration to protect the integrity of the term and the principles it represents as well as to ensure its just and transformative contribution for (re-)shaping agri-food systems.

## 1. Introduction

Today's agri-food systems are facing multiple interconnected and overlapping challenges, such as food insecurity, environmental degradation, biodiversity loss, soil damage, urbanization and complex social and economic dynamics and injustices (Booth et al., 2022; Breeman et al., 2015; Moragues-Faus et al., 2017; Rundgren, 2016). These problems are interdependent and commonly referred to as “wicked problems” due to their inherent complexity, uncertainty, and different perceptions of causes and solutions among socially diverse actors (Head and Alford, 2015; Peters and Pierre, 2014; Termeer et al., 2019; van Bers et al., 2019).

In response to the complex and interlinked challenges faced by agri-food systems, various scientists, politicians and activists worldwide are calling for radical, systemic transformations (Baker et al., 2021; McGreevy et al., 2022; Rossi et al., 2021; Temper et al., 2018; Vicente-Vicente et al., 2022). However, there is no single solution to the

complexity, locality and contextuality of issues. Therefore, various approaches have been proposed on both regional and global scales (Dengerink et al., 2021; Vittuari et al., 2021) that address different aspects of these issues, often by following a systemic perspective. Alternative food networks (AFNs) (Goodman et al., 2013; Renting et al., 2003; Zoll et al., 2021), social innovations with a focus on food and agriculture (Fernandez-Wulff, 2019; Rossi et al., 2021), integrative approaches towards food system governance (Candel and Pereira, 2017) and agroecology (Anderson et al., 2019b, 2021; Levidow et al., 2014) are discussed, *inter alia*, as models for sustainability-oriented change in agri-food systems. These models share similar, often complementary aims regarding addressing the underlying causes of problems, rather than treating the symptoms (Temper et al., 2018).

This paper focuses on agroecology as a systemic and transformative approach to the sustainability of food systems (Tuttonell, 2023). Specifically, agroecology, as a science, practice and social movement, combines ecological principles with social and economic considerations

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(Anderson et al., 2019b; Rivera-Ferre, 2018; Wezel et al., 2020) for systemic change in the agri-food system regarding climate, food, ecosystem crises and social injustices (Bezner Kerr et al., 2023). As such, agroecology goes beyond incremental changes and tackles the unsustainability, social injustice, and paradigm shifts that are necessary to create resilient and just food systems and societies. Accordingly, agroecology is inherently transformative, focuses on agri-food systems, and integrates plural epistemologies and knowledge from different actors and positionalities (for details see Section 2).

The term “agroecology” has become increasingly popular in scientific, agricultural and political discussions over the last decade (Gliessman and de Wit Montenegro, 2021; HLPE, 2019), with special relevance in the non-academic and non-Anglophone realm.<sup>1</sup> However, its usage is not universal and its meaning varies greatly in different contexts, leading to “many agroecologies” (Holt-Giménez and Wang, 2011; Lamine et al., 2021; Rivera-Ferre, 2018). According to Rivera-Ferre (2018), these various interpretations of agroecology are actually interconnected and assemble different perspectives or storylines of the same overarching narrative. A comprehensive and transformative approach to agroecology integrates scientists, policymakers and practitioners in the decision-making process in agriculture. It is important for the different sub-narratives to complement each other in order to achieve a systemic view of agroecology. By contrast, fragmented interpretations of agroecology, treating its *science*, *practices* and *social movement* separately, make it challenging to identify different mental models being associated with agroecology (Rivera-Ferre, 2018).

It is important to understand the different narratives within agroecology and their (non-) transformative goals regarding food systems, so that coherent and supportive policies can be created and conventionalisation dynamics can be identified and overcome (Ajates Gonzalez et al., 2018; Rivera-Ferre, 2018) to develop the full sustainability potential of agroecology. Specific configurations of power relations between actors fuel the meaning of terms such as agroecology or food sovereignty, in particular when applying them to specific policies. Ideological positions, social classes, alliances, and political power are thus central dimensions of the meaning of agroecology, which can deploy conventionalization of agroecology, or rather a deepening of its transformative potential. Agroecology was developed and promoted by peasant organisations, food movements and researchers committed to the transformation of the global food system towards social-ecological sustainability and justice. However, its conceptual translation into specific policies by states and global institutions has been biased towards conventionalisation, and thus as a way to strengthen the corporate food regime, becoming a mirror of the power relations in the global food system (Ajates Gonzalez et al., 2018; Anderson et al., 2019b; Giraldo and Rosset, 2017; Giraldo and McCune, 2019; Holt Giménez and Shattuck, 2011; Levidow et al., 2014).

Accordingly, in this paper, we take the position that the core issue is not the different understandings/interpretations of agroecology, but whether these foster respect for the various transformation domains and enhance system resilience. This is vital for achieving social-ecological sustainability, stability, and justice across the entire food system. In other words, not just the meaning per se, but the purpose of referring to agroecology matters, as well as the power relations in which such a meaning is embedded. The use of agroecology as a normative term is always political. Actors, contexts and epistemologies that inform its use inherently elucidate the politics of the term (e.g. Sullivan, 2023). Any reduced, selective or distorted meaning intentionally or inadvertently ignoring a systemic approach and respect for life does not conform with

the agroecology principles (cf. HLPE, 2019) and hinders its emancipatory and transformative potential. Using the term agroecology with a neoliberal perspective, for example, while using substances associated with the risks to human or environmental health, or when promoting farming systems that increase the dependence of (family) farmers<sup>2</sup> (e.g. on agrochemicals and other resource-intensive inputs), undermines its sustainability potential by neglecting its systemic problem and solution perspective. Such reductionist approaches devalue cultural practices and largely neglect central agroecological aspects such as social-ecological sustainability and justice, despite their being essential in the most cited scientific works on the topic (Altieri, 1987; Dalgaard et al., 2003; Francis et al., 2003; Gliessman, 1998; Mason et al., 2021; Méndez et al., 2013; Rosset and Altieri, 2017; Wezel et al., 2009).

Against this backdrop, the paper aims to reflect on the flourishing use of the term agroecology in diverse contexts and with various meanings. Accordingly, the paper presents a framework to assess the transformative potential of agricultural approaches that make use of the term agroecology. This is done by examining the principles and values that either facilitate or impede realizing the sustainable potential of an agricultural approach to farming practices (also to networks, policies and governance configurations). As such, the framework can be seen as a guiding tool for researchers to distinguish between enabling and disabling meanings and applications of agroecology in their scientific approaches and projects.

The following sections will first conceptualize an understanding of agroecology as a systemic and transformative approach to the sustainability of food systems (Section 2) before introducing a framework that integrates previous works (Anderson et al., 2021; Anderson and Anderson, 2020; Holt-Giménez and Wang, 2011; Lamine et al., 2021; Rivera-Ferre, 2018) (Section 3). We will apply the framework exemplarily to specific approaches that have used the term agroecology (Section 4) and discuss our findings on whether this constitutes hijacking (Section 5.1), as well as potential implications for science and policy (Section 5.2). The paper concludes with remarks on the results and limitations of the study (5.3), and opportunities for future research to support sustainable change in agri-food systems (Section 6).

## 2. Conceptualizing agroecology

*Agroecology* is a long-standing term, evolving over the last few decades, thanks chiefly to its development and application in mainly Latin American countries (Altieri and Nicholls, 2017). From a scientific discipline and set of farming practices, it has expanded to become a wide movement which strives for and actively develops transformative policies on rural development, sustainable food systems and food sovereignty (González De Molina et al., 2019; Wezel et al., 2020, 2009). Sullivan (2023) characterizes agroecological farming practices as involving diverse crop systems, reduced dependence on external resources, incorporation of indigenous and traditional knowledge, and an increasing association with political demands of a more equitable food system. Nowadays, agroecology is understood scientifically as the “ecology of (the entire) food systems” (Francis et al., 2003; Mason et al., 2021), as it incorporates the social and political dimensions, as well as other emergent processes expressed at the food system scale. It can be defined as

“The integration of research, education, action and change that brings sustainability to all parts of the food system: ecological,

<sup>1</sup> An English search string for “agroecology” or “agro-ecology” on lens.org (considering titles), for instance, revealed that only 50% of the 2826 results were classified as scientific peer-reviewed articles. The ratio is even less balanced when searching for Spanish terms (“agroecología” or “agro-ecología”), resulting in 4185 results (date of search 13 April 2023).

<sup>2</sup> We refer to (family) farmers as one example of the social subject of agroecological transitions on the food system’s scale (González de Molina et al. 2019). This does not mean that agroecologists can only be family farmers. Instead, we conceptualize agroecologists as those actors that follow, embody and practice agroecological principles. This can – in principle – be a variety of social actors from very different social positions, such as farmers and peasants, but also urban food movements, researchers and others.

economic, and social. It is transdisciplinary [...], participatory [...] and action-oriented [...]. The approach is grounded in ecological thinking where a holistic, systems-level understanding of food system sustainability is required" (Gliessman, 2018, p. 599).

While the evolving use of the term agroecology reveals a growing influence on other disciplines and approaches, it also carries the risk of further conventionalising the term and allowing the commodification of food systems, if the systemic perspective is neglected by failing to consider the social, environmental and political dimensions holistically (González De Molina et al., 2019; IAFN, n.d.). The flourishing use of the term (see footnote 1 and Altieri et al. 2021; Wezel et al. 2020) has been focusing increasingly on socio-economic aspects, shifting from the farm level to a food systems level (Gliessman, 2016; Mason et al., 2021) which enhances economic and ecological approaches by incorporating anthropological, ethnographical, sociological and ecological perspectives (Nicholls and Altieri, 2018). Sullivan (2023) identifies that these different aspects can result in a fragmented approach to agroecology via incompatible epistemologies, some of which uncritically accept the principle of commodifying food systems. A fragmented or selective interpretation of agroecology dilutes or even hijacks or co-opts the concept's essence (Alonso-Fradejas et al., 2020; Altieri and Holt-Giménez, 2016; Anderson et al., 2021; Giraldo and Rosset, 2017, 2022; Lamine et al., 2021; Rivera-Ferre, 2018; Wezel et al., 2018). Accordingly, the disputes on the (immaterial) meaning of agroecology reflect not only rhetorical differences but conflicts of interests on material territories, such as access to land, water, seeds or knowledge (Giraldo and Rosset, 2017). González de Molina (2020) distinguishes three processes which perform the "systemic rejection" of the corporate food regime towards agroecological experiences: (1) the "expulsion effect", making experiences disappear after a certain time; (2) the "encapsulation effect", confining them to a marginal area of agroecological production and consumption; and (3) the "conventionalisation effect", removing the alternative traits and pushing them towards a behaviour that is similar to that of the rest of the food system. Alonso-Fradejas et al. (2020) refer to "junk agroecology" to illustrate how the term agroecology loses its meaning and usefulness once it is misappropriated, in this particular case by the sustainable intensification (SI) approach (see Section 4 for a detailed explanation on SI). Sullivan (2023) highlights the different epistemologies underlying agroecology, on the one hand, and hi-tech, SI approaches on the other, stressing the contradictory convergence between both approaches. In this context, Giraldo and Rosset (2022, p. 2) refer to "neoliberal agroecologies" as those based on "the conventional monoculture model of industrial agriculture, moderated by the introduction of some agroecological technologies". Similarly, Faure (2021) considers SI as an incremental innovation following the same pathway as the Green Revolution and its dramatic, negative effects on the environment.

However, following a holistic approach, agroecology values and integrates diverse and systemic perspectives, and acknowledges multiple forms of knowledge (production) (Anderson et al., 2021, 2019a; Utter et al., 2021). According to Rivera-Ferre (2018), different perspectives from science, practice and social movements are interrelated and represent separate storylines of the same "metanarrative". As an example, agroecology-based local agri-food systems can be characterized as assemblages of human and non-human actors, including agroecological experiences, administrations, policies, infrastructures, landscapes and others (López-García and González de Molina, 2021). They thus focus on multidimensional interlinkages and their outcomes (food security and other ecosystem services) rather than on yields or financial revenues. Such a metanarrative integrates perspectives that are important for systemic transformations to social-ecological sustainability in knowledge societies (Rivera-Ferre, 2018). Therefore, a systemic and holistic view of agroecology can only emerge through the integration of perspectives from different social positionalities, knowledge and realities. The integration of these perspectives in agroecological

approaches is a necessary condition for change, as Wezel et al. (2020) argue, since transformations to more sustainable food production and consumption occur through fundamental changes in rules, practices, institutions, values and shifts in politics, socio-culture, economy, environment and technology.

The scientific body of literature on agroecology that integrates science, practices and social movements has been developed mainly by assessing real interventions in countries in the Global South, where agroecology has a strong history (Anderson and Anderson, 2020; Mier y Terán Giménez Cacho et al., 2018). Agroecology experienced a significant increase as a movement in Latin America after realizing the social and ecological consequences of the Green Revolution (Altieri and Nicholls, 2017). Currently agroecology is experiencing another increase as a counter-movement against 1) the so-called "Second Green Revolution" of biotechnology and the spread of GMOs, and synthetic pesticides and digitalisation (Altieri et al., 2021) and 2) the co-optation of the agroecology term in reference to these approaches (Altieri, 2021). Important contributions originate in particular from studies in Latin America (Altieri, 1987; Altieri et al., 2021, 2019; Altieri and Nicholls, 2017; Funes, 2002; Gliessman et al., 1981; Nicholls and Altieri, 2018), which emphasize the revival of traditional, place-based knowledge and practices (Isaac et al., 2018) and how agroecology can be scaled (Mier y Terán Giménez Cacho et al., 2018). In these contexts, culture (e.g. values, identities, and norms) is recognized as a significant source of agroecological knowledge (Méndez et al., 2013), with indigenous knowledge playing a crucial role in implementing and advocating for nature-based principles in agriculture (Toledo and Barrera Bassols, 2009). Moreover, research has shown that agroecology has positive effects on environmental, economic, nutritional and human health, and socio-cultural aspects (Altieri et al., 2021; Bezner Kerr et al., 2021; D'Annolfo et al., 2017; Palomo-Campesino et al., 2022; van der Ploeg et al., 2019).

Agroecology is commonly seen as a response that challenges the historically grown and institutionalized impetus of "maximizing agricultural yields over other socio-economic, environmental and bio-cultural objectives" (Isaac et al., 2018). Such responsive expressions of agroecology can be seen in some community-led and small-scale initiatives, such as community-supported agriculture, community food hubs or market gardens (Drottberger et al., 2021), which have embraced agroecology as part of sustainable AFN linked to urban food movements. Agroecology has also spread as an alternative for the survival of small- and medium-sized farms in Europe, as farmers reorganize their strategies towards input reduction and local markets (van der Ploeg et al., 2019). This has led to the creation of agroecology-oriented farmers' groups to supply the emergent demand for local and fair organic agri-food products and promote agroecology-oriented agri-food policies (López-García and Carrascosa-García, 2023), establishing rural-urban linkages with the support of urban food policies (Passaro and Randelli, 2022; Vaarst et al., 2018). However, such agroecological experiences are not yet widespread and are often small and isolated from each other. Agroecology is made more precarious by an ecosystem of policies, regulations and social, cultural and economic mechanisms that hinder its ability to strengthen and grow, or pushes actors (e.g. farmers) towards conventionalisation, on what has been called the 'systemic rejection effect' from the corporate food regime on such initiatives (González de Molina, 2020; González De Molina and Lopez-García, 2021).

The scientific concept of agroecology has been systematised in recent years into 10 elements by the Food and Agriculture Organization of the United Nations (FAO, 2018) and 13 principles by the High Level Panel of Experts on Food Security and Nutrition (HLPE, 2019). These elements and principles take into account ecological, social, economic and governance aspects of food systems. The 13 principles have proved to be useful in studying different transition pathways in food system changes, and been linked to the five levels of agroecology-oriented food system change by Gliessman (2016). Food system changes can occur by following these principles, and agroecology is transformative on a

systemic level by creating real changes in local food systems. Fig. 1 shows how food system changes can take place through applying and using the 13 principles (for a detailed description, see Wezel et al., 2020).

### 3. An integrative framework on agroecology

The following sections take up the conceptualization of agroecology as an approach that is intrinsically transformative towards comprehensive, social-ecological sustainability. We further introduce an integrative framework to assess whether specific farming approaches which are identified with agroecology can be regarded as transformative or not.

Although the scientific definition of agroecology is well-established, its practical implementation varies depending on the context and the processes involved can be messy, open-ended and non-linear (Anderson and Anderson, 2020; Lamine et al., 2021; Mier y Terán Giménez Cacho et al., 2018). There are multiple ways to transform farming and food systems based on the social-ecological systems approach (Wezel et al., 2009). However, as has been mentioned above, these perspectives are not always consistent and can even impede the transformative potential of agroecology (Rivera-Ferre, 2018; Sullivan, 2023). We have developed an integrative framework to help scholars and practitioners identify practices and narratives that support or hinder the transformation of food systems (Fig. 2), in order to understand and navigate better within the various uses and meanings of agroecology.

The framework combines previous works from literature (Anderson et al., 2021, 2019a; Anderson and Anderson, 2020; Giraldo and Rosset, 2022; Holt Giménez and Shattuck, 2011; Holt-Giménez and Wang, 2011; Lamine et al., 2021; Rivera-Ferre, 2018) and links them like building blocks into an integrative framework. Holt Giménez and Shattuck (2011) and Holt-Giménez and Wang (2011) provide the scale of transformation ranging from neoliberal (or business as usual) towards reformist, progressive and radical transformations. The core elements of the framework include the “domains of agroecology transformations” that were introduced by Anderson et al., (2019a); (2019b); (2021). According to these authors, these domains are the key areas where collective action and transformation are most powerful. There are six domains identified, including i) the right to nature and resources, ii) knowledge and culture, iii) systems of economic exchange, iv) networks, v) equity, and vi) discourses. Due to the high relevance of governance for steering agri-food system transformations (Booth et al., 2022; Marsden et al., 2018; van Bers et al., 2019), it was included as a seventh domain.

These domains are not to be understood as separate but as interconnected, complementary and co-constitutive to each other. Taken together, the domains allow for a territorially or landscape integrated approach, in which particular expression and relevance of each domain supports the constitution of an integrated context-specific pathway to the fundamental system change. The domains and their relevance for agroecology can be understood as explained in Table 1. Finally, the content of the domains was complemented and supported by other sources, creating a comprehensive picture of expressions which disable or enable agroecology and thus hinder or facilitate an agri-food system transformation (Giraldo and Rosset, 2022; Lamine et al., 2021; Rivera-Ferre, 2018) (Fig. 2).

The framework in Fig. 2 shows the interconnected domains (vertical columns) of agroecology, as well as agroecology enabling and disabling expressions within each domain (i.e. translations of agroecology into policies and practices) (Ajates Gonzalez et al., 2018). The expressions towards the top of the figure are more enabling of the social-ecological sustainability potential of agroecology, while those at the bottom are more disabling. Expressions in the middle can be ambivalent and may result in hindering or facilitating effects on the system transformation depending on their connections with other expressions and domains (Anderson et al., 2021). Following Lamine et al., (2021), p. 30: “[h]ow agroecology is pursued, can matter for how it turns out”. Therefore, expressions in each domain can signal disabling or enabling conditions for sustainable agroecology (Fig. 2, left axis), while their contribution to overall agri-food system transformation ranges from maintaining business-as-usual, to incremental and stabilizing reforms, or paradigm shifting (Fig. 2, right axis) (see also (Anderson and Anderson, 2020; Giraldo and Rosset, 2022; Holt-Giménez and Wang, 2011, Holt-Gimenez and Shattuck, 2011).

By integrating the work by previous scholars, we have developed a complex and comprehensive framework that links different expressions of agroecology and their effects on the overall food system, ranging from maintaining stability to developing a different paradigm and thus fostering a systemic transformation. Additionally, the framework holds three specific characteristics to make it applicable, as it is:

- i) *general* enough for applying it to different approaches that have been related to agroecology (e.g. SI, conservation agriculture [CA], regenerative farming [RF] and organic farming [OF]);

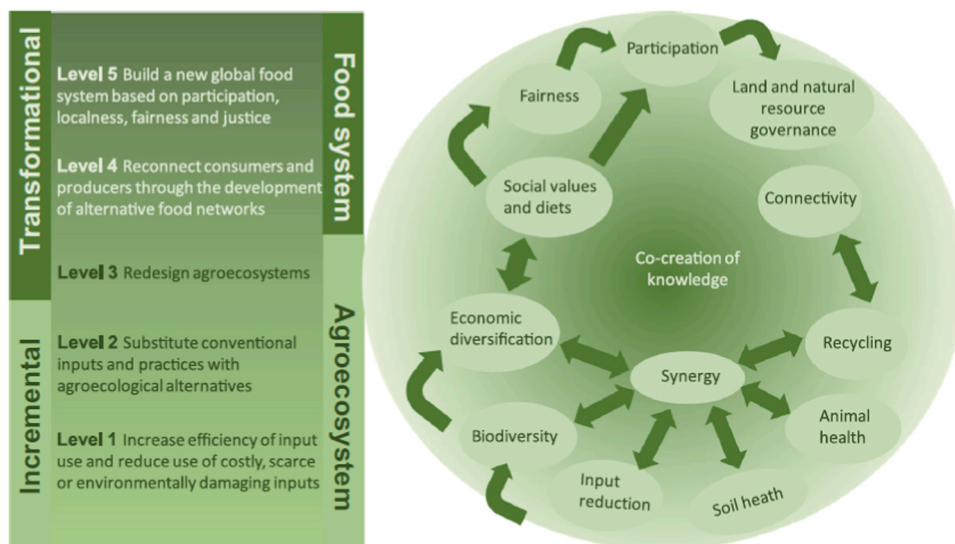


Fig. 1. Principles of agroecology linked to the levels of food system change (Wezel et al., 2020), based on Gliessman (2016) and the High Level Panel of Experts on Food Security and Nutrition (HLPE, 2019).

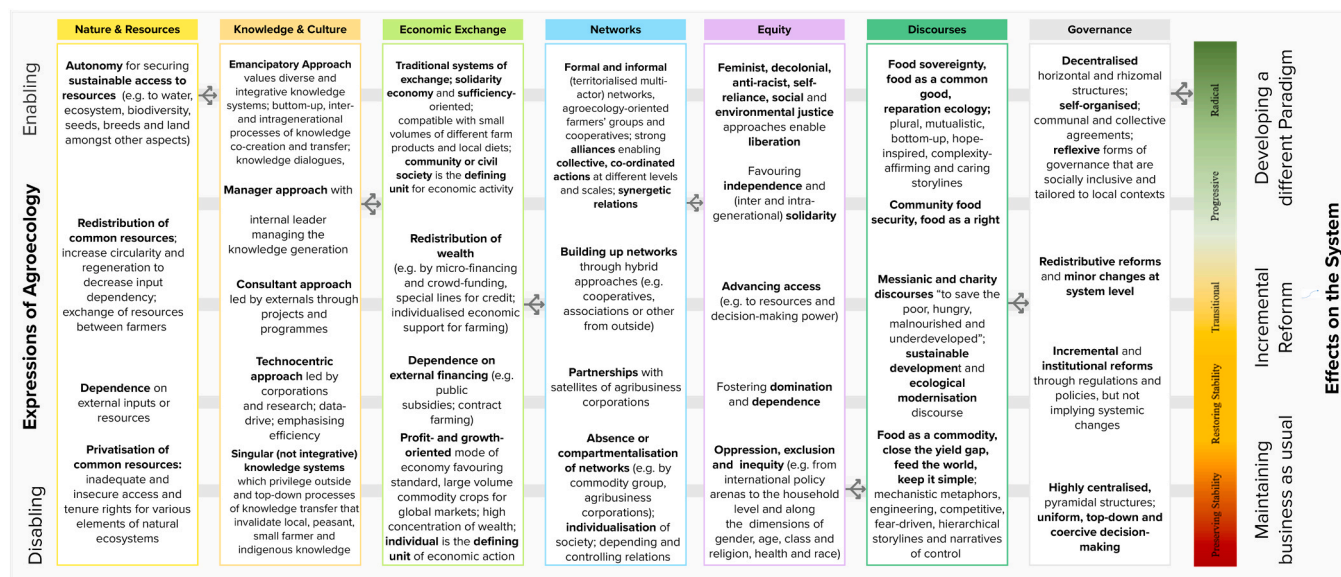


Fig. 2. Integrative framework on agroecology constituted of domains of transformation (columns), different expressions of agroecology (content in columns) and system effects (gradient on the right side). Grey arrows between columns are symbolic and indicate that domains are not linearly connected, but can have differing enabling and disabling expressions in different examples and contexts.

- ii) specific enough for applying it to single cases of agroecological practices (e.g. community-supported agriculture or other food initiatives); and
- iii) flexible enough for applying it in different contexts, thus covering Global North and South

Because of the general, specific and flexible characteristics, the framework is versatile and can be applied in various contexts, applying to different interpretations of the term agroecology, and allowing for multiple expressions and combinations (shown by grey arrows between domains). A disabling use of the term agroecology, for example, could involve a reductionist approach and reformist narratives that follows a neoliberal and depoliticised perspective (Bezner Kerr et al., 2023; Giraldo and Rosset, 2022) emphasizing the inability to close the yield gap as a key issue within agri-food systems. The solutions proposed by reductionist approaches would focus on increasing production through resource-efficient methods. Such approaches often rely on technocentric solutions, which can be fragmentalized, recombined, scaled up and promote the commodification of food and dependence on external knowledge and inputs rather than collective, endogenous practices through networks (Anderson et al., 2021; Lamine et al., 2021; Levidow, 2015; Marfurt et al., 2023; Rivera-Ferre, 2018; Sullivan, 2023). A disabling view of agroecology is often strung together with engineering and management storylines, narratives of “keeping it simple” and control (e.g. over nature) and by using mechanistic metaphors and productivist imaginaries of infinite growth (Lamine et al., 2021; Rivera-Ferre, 2018). A disabling view is also characterized by top-down governance structures, colonial practices and patterns, and is driven more generally by the imperative of growth and development (Giraldo and Rosset, 2022; Marfurt et al., 2023). Disabling narratives emphasize international collaboration and transnational corporations, reinforcing the dependence on project-based development at the expense of grassroots movements (Bottazzi and Boillat, 2021).

An enabling use of the term agroecology is politically focused, viewing the evolution of farming practices towards a profit-driven agro-industrial monoculture system as a problematic issue, because it depends on global trade and external inputs, marginalization of social actors, and negative environmental externalities (Guzmán et al., 2022; Levidow, 2015). Such approaches regard problems as complex and marked by uncertainty rather than simplifying them via reductionist

conceptions. Enabling solutions mentioned in agroecological literature value diverse traditional and indigenous knowledge, promote farmers’ cooperation and self-organization, horizontal networks and community alliances, advocate for redistributive reforms, and prioritize social justice to bring together social and ecological sustainability (Anderson et al., 2021; Bakker et al., 2023; Giraldo and Rosset, 2022; Holt-Giménez and Wang, 2011; Marfurt et al., 2023; Rivera-Ferre, 2018). Enabling agroecological approaches embrace plural, mutualistic, bottom-up, hope-inspired, complexity-affirming and caring storylines (Lamine et al., 2021). These approaches can foster social learning, defined as a change in understanding beyond the individual through social interactions in wider communities (Reed et al., 2010) and is achieved through new social relations, institutions and practices (López-Rodríguez et al., 2019) within the agroecological approach.

While the examples above represent two extremes of a continuum between supportive and hindering interpretations of agroecology, in reality, there is no clear border between them (Bellon and Ollivier, 2018). Instead, different approaches using the term “agroecology” have ambiguous or ambivalent allocations in specific domains, as shown in Sections 4 and 5. Pointing out the differences between these different meanings of agroecology helps us to understand how the concept can support transforming agri-food systems instead of being integrated into and co-opted by the neoliberal and productivist growth paradigm (Giraldo and Rosset, 2022; Levidow, 2015).

A more general distinction regarding agroecology is the presence or absence of social and political aims (e.g. social equity and justice, participation and transparency in decision-making and knowledge sharing, or responsible policy and governance structures). Unbalanced shares of margins and prices along the food chain result in major pressures on farmers towards overexploitation of human and non-human work, and thus, social and ecological unsustainability (Guzmán et al., 2022). Such a global pricing system is politically regulated and reproduced (González De Molina et al., 2019; Thomas, 2017). Hence, any conception of agroecology that excludes the dimension of power imbalances in the food system cannot be considered as transformative (Giraldo and Rosset, 2022; Tittone et al., 2022). To illustrate our point, the following Section 4 applies the framework to common examples of agricultural approaches that have recently made use of the term agroecology in order to present a blueprint of how the framework can be applied in practice.

**Table 1**  
The seven domains included in the framework and their explanation.

Domain	Understanding
<b>Nature and Resources</b>	This domain concerns the right to natural resources, such as land, forests, water, fisheries, seeds and biodiversity (Anderson et al., 2021). The access to and redistribution of these resources are crucial for motivating farmers and communities to adopt agroecological practices and make long-term changes (Anderson et al., 2021; Holt-Giménez and Wang, 2011). Autonomy (both on a farm and food systems' scale) is a key concept for securing sustainable access to both nature and resources (González De Molina et al., 2019). This domain can also promote a more democratic relationship between society and nature, as seen in commoning approaches that aim to decommodify nature and move beyond conservation (Peredo and McLean, 2020; Porcheddu, 2022).
<b>Knowledge and Culture</b>	This domain concerns knowledge and culture within agroecology, which includes local practices, research, innovation and education (Anderson et al., 2021). How knowledge is created, shared and used is crucial for driving transformative change. The domain recognizes the politics of knowledge production and equal value of diverse and integrative epistemologies, including scientific, indigenous and traditional knowledge, in creating sustainable agri-food systems along place-based ecologies of knowledge (Anderson et al., 2021; Global Alliance for the Future of Food, 2021; Oteros-Rozas et al., 2019; Rivera-Ferre, 2018). This domain questions the hegemony of specialized, reductionist, and managerial knowledge by acknowledging multiple perspectives and uncertainties inherent in transformations. This domain is about the circulation of agricultural products from producers to users and the acquisition of inputs that cannot be produced on the farm. This includes formal and informal practices, for example, exchanging products such as seeds, livestock breeds and labour. Accessible, fair and profitable markets are crucial to overcome barriers in agroecological transformations (González De Molina et al., 2019; van der Ploeg et al., 2019). Territorially embedded relationships and AFNs can provide such markets for farmers and consumers (Anderson et al., 2021; Mier y Terán Giménez Cacho et al., 2018).
<b>Economic Exchange</b>	This domain focuses on collective actions through formal and informal networks, which are crucial for agroecological transformations (López-García and González de Molina, 2021). These networks can be local organizations, civic-driven groups, or people-centred approaches (e.g. agroecology-based food hubs (Klebl et al., 2022), territorialized multi-actor networks (e.g. biodistricts (Passaro and Randelli, 2022)), agroecology-oriented farmers' groups and cooperatives (López-García and Carrascosa-García, 2023), which differ from state or market perspectives. Trust-based relationships and bottom-up social democratic processes sustain these networks in an agroecological approach (Anderson et al., 2021; Méndez et al., 2017).
<b>Equity</b>	This domain refers to practices and processes promoting equity and countering marginalization, discrimination and oppression based on gender, culture and ethnicity. Achieving intersectional equity is crucial for overcoming unequal access to nature and resources, knowledge systems, adequate food and decision-making (Anderson et al., 2021; Di Masso et al., 2022). Social justice, environmental justice, sustainable food security and political agroecology are essential for a systemic and holistic approach to agroecology (González De Molina et al., 2019; Rivera-Ferre, 2018).
<b>Discourse</b>	This domain focuses on how language and representations are used to shape debates, policies and actions in agroecological transformations. Discourses describe, shape and justify practices and policies, and use problem frames and narratives to communicate challenges and responses in the agri-food system (Anderson et al., 2021; Levidow, 2015; Rivera-Ferre, 2018), and to construct or reconstruct collective actors around reparative ecologies (Cadieux et al., 2019; González De Molina et al., 2019).
<b>Governance</b>	This domain is about reassembling and mobilising collective action to address power imbalances among the food systems (López-García and González de Molina, 2021; Marsden et al.,

**Table 1 (continued)**

Domain	Understanding
	2018). It embraces the construction of alliances between citizens, civil society organizations, businesses and governments to structure and shape agri-food systems, from production to waste management (Anderson et al., 2021; Hospes and Brons, 2016; Termeer et al., 2018). Governance interventions typically involve policies, new economic arrangements, capacity building and decision-making protocols to facilitate agroecological transformations (Anderson et al., 2021; González De Molina et al., 2019). It also involves territorialized governance approaches of sustainable AFNs that focus on multi-stakeholder cooperation dynamics among economic and social actors (Sanz-Cañada et al., 2023) and the territorialized methodologies to promote such assemblages (López-García and González de Molina, 2021; Méndez et al., 2017).

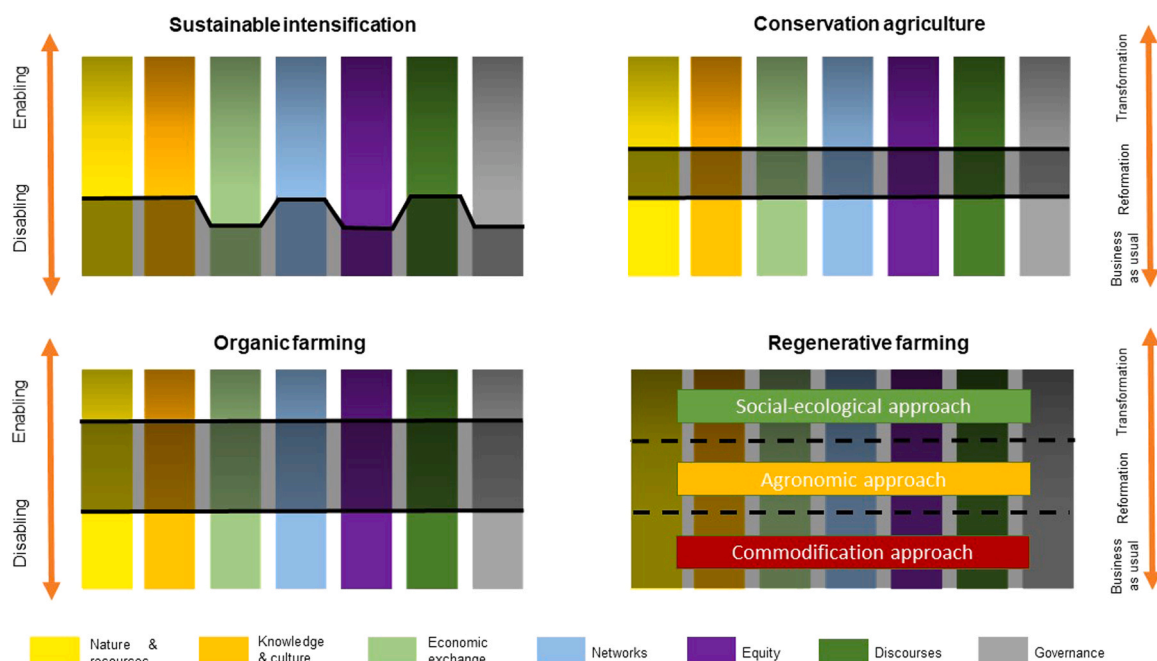
#### 4. Applying the integrated framework of agroecology

The next section applies the framework developed in Section 3 to four approaches exemplarily: sustainable intensification (SI), conservation agriculture (CA), organic farming (OF) and regenerative farming (RF). These approaches often rhetorically associate themselves with agroecology, by using the term and claiming to be influenced by or contributing to agroecology (Alletto et al., 2022; Garbach et al., 2017; Pretty, 2018; Testani et al., 2020; Tittonell et al., 2022). Additionally, underlying narratives within these approaches have been analysed and compared previously regarding their transformative potential (Bless et al., 2023). Apart from the scientific publications previously mentioned, international organisations have argued these approaches to be the ones that might co-opt agroecology (Alonso-Fradejas et al., 2020; Friends of the Earth International, 2022; GRAIN, 2022; IATP, 2022; IFOAM, 2019; IPES-Food, 2022; La Via Campesina, 2018). These four approaches are therefore representative examples to illustrate the framework's application. We want to note that the framework is general, specific and flexible enough to be applied to approaches that go beyond food production (e.g. AFNs, food hubs) and to evaluate their transformative use of the term agroecology.

The framework was applied to evaluate how the approaches mentioned above perform enabling or disabling conceptions of agroecology in each domain based on a brief literature review. Fig. 3 provides an overview of the assessment of each approach, and Table 1 details the framework's domains and how each approach was located within them, as well as representative sources used for the classification (see Supplementary Material for detailed figures).

##### 4.1. Sustainable intensification (SI)

Initially, SI aimed to address low-yield and environmentally harmful agricultural systems (Pretty, 1997), for example, by promoting resource efficiency (Weltin and Hüttl, 2023). Therefore, as Alonso-Fradejas et al., (2020) point out, the approach could be seen as a partial goal of agroecology. If combined with enabling aspects, such as diverse knowledge systems and decentralised and reflexive governance, the SI approach could foster agroecology. However, when evaluating actual developments of SI in specific farming practices using our framework, we found it to be a rather disabling approach for agroecology (see Table 2 and Fig. 3). The primary focus of SI is to increase yields and profits through the efficient use of resources (e.g. via precision-farming practices (Weltin et al., 2018)), but does not consider a full life cycle sustainability assessment, nor political or social aspects beyond production at higher system scales. Increased yields and profits are often achieved through top-down processes facilitated by large corporations, which supply farming inputs that cannot always be seen as sustainable (e.g. pesticides, inorganic fertilizers, seeds) (Bronson, 2015; Joseph, 2021; Rana, 2021; Schubert, 2005) and technologies (e.g. for data



**Fig. 3.** Summary of the results of the seven domains and the framework described in Fig. 2 for the four approaches described: sustainable intensification (SI) and precision farming, conservation agriculture (CA), organic farming (OF) and regenerative farming (RF). The way each domain is addressed can enable or disable agroecology and therefore contribute to supporting the business-as-usual scenario, a reformation, or transformation of the food system.

collection) (Carolan, 2018; Jarial, 2022). This approach tends to undermine the knowledge of family, local and indigenous farmers, leading to dependency and inequity, particularly through the exclusion and oppression of smallholders and vulnerable groups (Thomas and De Tavernier, 2017). Consequently, these approaches align with discourses that treat food as a commodity and advocate for ecological modernization, with a strong emphasis on resource efficiency and, more recently, on the application of technologies based on information and communications technology and artificial intelligence in precision and smart farming (e.g. robots and sensors), as well as the use of genetically modified organisms (e.g. Finger, 2023; Finger et al., 2019; Husaini and Sohail, 2023). However, they fail to address power inequalities along the food chain, both upstream and downstream (Levidow, 2018). In that context, these approaches perpetuate farmers' dependencies on corporations without addressing the root causes of modern crises (Alonso-Fradejas et al., 2020).

Sustainable intensification is a yield- and profit-oriented approach. However, other approaches, such as CA, OF and RF, often do not merely prioritize yields, aiming instead to harmonize yields with conserving and improving soil health, enhancing biodiversity and reducing negative impacts of agriculture on the environment. They often refer to the application of "agroecological practices". Therefore, we also applied the framework to these three practices, which are not exclusively oriented on the yield and compared the outcomes with the ones obtained for SI.

#### 4.2. Conservation agriculture (CA)

When applying the framework, CA falls between the enabling and disabling transformative agroecology (see Table 2 and Fig. 3). It follows a technocentric or managerial approach (Chatterjee and Acharya, 2021; Giller et al., 2015) focused on applying sustainable management practices such as reducing tillage and using cover crops to improve soil properties (Abdallah et al., 2021; Hussain et al., 2021; Stagnari et al., 2020) and related ecosystem services (Jayaraman et al., 2021). The actual application of sustainable management practices involves extensive use of inorganic fertilisers and synthetic pesticides, producing input dependencies and environmental unsustainability. It also involves

knowledge exchange and social learning in existing social networks, which can reduce dependencies on external knowledge inputs. However, CA is limited in pursuing a transformative concept of agroecology as it only contributes to the reformation of specific and local farming practices. Other problems remain, including farmers' external dependencies and a disregard for producers' position in the food chain and their access to markets and revenues. CA does not therefore inherently acknowledge the wider social, economic and political systems and landscapes where agricultural practices are embedded.

#### 4.3. Organic farming (OF)

Organic farming is a wide and diverse field of agricultural practices that could be classified in our framework as a reformatory approach (see Table 2 and Fig. 3). It comprises a wide range of situations, farmers' profiles and farming practices that can be subsumed (or not) in global markets and industrial logics (González De Molina et al., 2019). Thus, when assessing the contribution of OF to agroecology, we have found two main approaches at each end of the spectrum. The first approach, which falls closer to disabling agroecology, focuses on monocultures and input substitution from a narrow, productivist and market-oriented perspective (Giraldo and Rosset, 2022; Jirí et al., 2022; Miyake and Kohsaka, 2020), ultimately maintaining system stability instead of transitioning to an agroecological system. By contrast, the second approach, which is more enabling to agroecology, addresses progressive principles such as fostering farmer independence, incorporating local knowledge and promoting food sovereignty (HLPE, 2019). This approach leads to the creation of multifunctional landscapes (Jirí et al., 2022) that can serve as transitional systems towards an agroecological approach (Migliorini and Wezel, 2017), and is linked to food systems' embeddedness in territories and alliances among producers, consumers and other local actors (López-García and Carrascosa-García, 2023; Passaro and Randelli, 2022). Although we have grouped OF into these two approaches, we are aware that specific real OF interventions can have elements of both.

Table 2

Results (i.e. categorization) of the seven domains described in Section 3 for some of the approaches identified that might be involved in the hijacking and/or appropriation of agroecology. Some references supporting the categorization have been included. The categorization is a result of the reference analysis and the judgement based on the expert knowledge of the authors.

Examples of approaches	Nature & Resources	Knowledge & Culture	Economic exchange	Networks	Equity	Discourses	Governance	References
<b>Sustainable intensification with precision farming</b>	Privatisation of common resources. High dependence on external resources	Technocentric and managerial approaches. Use of technology to maximize yields using the optimal level of resources	Profit- and yield-oriented through commodification of food	Individualisation. Applicable in large cropping systems. Partnerships with agribusiness corporations	Fostering inequity through input dependencies and expensive high-tech facilities in large farms	Food as a commodity evolving towards ecological modernisation (e.g. resource efficiency, monitoring and big data)	Top-down and typically coercive decision-making	(Alonso-Fradejas et al., 2020; Bronson, 2015; Carolan, 2018; Collins and Chandrasekaran, 2012; Levidow, 2015; Pretty, 2018)
<b>Conservation agriculture</b>	Redistribution of common resources. Typically substantial dependence on external resources	Technocentric and managerial approaches. Specific mechanization to avoid soil disturbances	Public subsidies for the application of sustainable management practices (e.g. payments for ecosystem services)	Building up networks for knowledge exchange in specific sustainable agricultural management practices	Reduces dependence of some resources and fosters access to mechanisation	Ecological modernisation through improving soil conditions	Policy reforms to incorporate sustainable management practices in subsidies (e.g. agri-environmental measures in the Common Agricultural Policy of the EU)	(Abdallah et al., 2021; Chatterjee and Acharya, 2021; Giller et al., 2015; Hussain et al., 2021; Jayaraman et al., 2021; Stagnari et al., 2020)
<b>Organic farming (low)*</b>	Redistribution of common resources	Technocentric and managerial approach to substitute inputs	Public subsidies for the application of OF to compensate expected lower yields	Building up networks for knowledge exchange in input substitution	Reduces dependence on agrochemicals and other resources	Ecological modernisation through input substitution affecting other ecosystem services (e.g. biodiversity) positively	Policy reforms to avoid the use of agrochemicals (e.g. OF regulations)	(Aulakh et al., 2022; Jiri et al., 2022; Le Campion et al., 2020; Miyake and Kohsaka, 2020; Stein-Bachinger et al., 2021)
<b>Organic farming (high)*</b>	Democratisation of access to natural resources	Consultant approach to increase knowledge and integration of some local and indigenous knowledge	Redistribution of wealth through civic-driven approaches	Building up alternative networks for knowledge exchange related to production and consumption	Fosters independence and solidarity through alternative networks	Fosters food sovereignty, sustainable and local food security and livelihoods. Higher agriculture-nature integration	Increase in horizontal and redistributive governance models	(Das et al., 2020; HLPE, 2019; Jiri et al., 2022; Jouzi et al., 2017; Migliorini and Wezel, 2017; Miyake and Kohsaka, 2020).
<b>Regenerative farming (low)* (C farming) (“commodification approach”)</b>	Privatisation of common resources. Dependence on external resources	Technocentric approach to optimize carbon sequestration	Profit-oriented through commodification of nature (e.g. carbon credits)	Emphasis on individualisation and large fields for profitability	Fosters inequity through fostering the socio-economic status quo	Soil organic carbon as a commodity (C credits)	Top-down and coercive decision-making	(Carbon Cycle Institute, 2021; Newton et al., 2020; Qian et al., 2022)
<b>Regenerative farming (medium)* (“agronomic approach”)</b>	Redistribution of common resources	Technocentric and managerial approach	Public subsidies for the application of RF practices and ecosystem services	Building up networks for knowledge exchange in specific soil management practices	Reduces dependence on some resources	Ecological modernisation through improving soil management and other RF practices	Policy reforms to incorporate RF practices	(Brown et al., 2021; Giller et al., 2021; LaCanne and Lundgren, 2018; Le et al., 2021)
<b>Regenerative farming 3 (high)* (“social-ecological approach”)</b>	Democratisation of access to natural resources	Diverse and integrative knowledge systems based on recovering local and indigenous knowledge or through the creation of lighthouses	Diversified traditional farms locally or regionally connected	Building up AFNs between producers and food citizens enabling knowledge (co-)creation, sharing and collective action	Incorporates principles and values, such as social justice, empowerment of women, de-colonialism or self-reliance	Food as a common good and food sovereignty as a result of bottom-up, diverse and complex movements. Agri-food system within nature. Regeneration of food systems	Horizontal models based on social inclusion and adapted to local conditions	(Anderson and Rivera-Ferre, 2021; Doherty et al., 2022; Gordon et al., 2021; Lymbery, 2021; Sabin et al., 2022; Sands et al., 2023; Umantseva, 2022)

\* Low, medium or high refers to the agroecological enabling capacity of the approach



#### 4.4. Regenerative farming (RF) and related emergent terms

In recent years, RF has appeared in order to foster climate change mitigation via reducing greenhouse gas emissions and/or carbon sequestration. It emerged from grassroots, social justice and social-ecologically embedded movements (Umantseva, 2022). However, there is no clear definition of RF (or “regenerative agriculture”) (Tittone et al., 2022), the focus is rather broad (Newton et al., 2020), and it overlaps with agroecology, organic farming and conservation agriculture (Manshanden et al., 2023; Tittone et al., 2023). Thus, the framework applied to RF illustrates three forms: i) the commodification approach with a limited capacity for boosting transformations, ii) the agronomic approach with a medium capacity, and iii) the social-ecological approach with a high capacity for enabling agroecology (see Table 2 and Fig. 3).

The first approach involves commodifying the benefits of RF for profit, for example, through carbon farming (Carbon Cycle Institute, 2021). It involves optimizing the CO<sub>2</sub> capture in landscapes by increasing the soil organic carbon content. If this is tied to payments for ecosystem services, involving the creation of financial instruments, such as C credits (i.e. “C farming” approach), or the overall goal of justifying net-zero CO<sub>2</sub> emissions (Qian et al., 2022) (i.e. “net-zero” approach), it results in the commodification of nature. A recent example is the European Union initiative on the Certification of Carbon Removals (European Commission, 2022), which allows C credits to be traded on voluntary C markets (European Environmental Bureau, 2022). RF is sometimes linked with the climate-smart agriculture (CSA) approach (e.g. (World Economic Forum, 2022)) – an emerging term also linked to CA (e.g. (FAO, 2022; Thierfelder et al., 2017), but far from clearly defined. RF is currently used as a framework for public policies which promote agricultural digitalisation and intensification (SI approach) (e.g. (Campbell et al., 2014; Codur and Watson, 2018; Ngoma et al., 2018; Roy and George K, 2020; Sahu et al., 2020; World Bank, 2021), especially in low-income countries (e.g. (Aisenberg, 2017; Shaw and Wilson, 2020; Ulimwengu and Kibonge, 2017; Yitbarek and Tesfaye, 2022). CSA has a focus on food security and climate change adaptation and mitigation (Hrabanski and Le Coq, 2022; Konfo et al., 2024) and is based on increasing resource efficiency under a technocratic approach (Gangwar et al., 2019) by, for instance, linking it with the application of precision agriculture techniques (Konfo et al., 2024), but without considering the specific context where they are applied, especially regarding smallholders’ perceptions (Smith et al., 2021). The RF view aims at improving soil health or restoring degraded soils with a strong focus on maintaining productivity and profit. However, the potential trade-offs with other socio-ecosystem components are rarely considered (Clay and Zimmerer, 2020) and thus, the commodification approach falls within the spectrum of disabling agroecology.

By comparison, the agronomic approach (Giller et al., 2021; LaCanne and Lundgren, 2018; Le et al., 2021) focuses on applying specific RF practices (including sustainable management practices), often aimed at improving soil health conditions. Therefore, for most of the agroecological domains, a lower dependence on external inputs and knowledge than CA signals a medium capacity for transformative agriculture. As has been mentioned previously, expressions in the mid-range can be ambiguous as they hold enabling or disabling effects on transformation depending on how they link up with expressions in other domains.

In contrast to the previous forms, the social-ecological approach of RF (Anderson and Rivera-Ferre, 2021; Doherty et al., 2022; Gordon et al., 2021; Lymbery, 2021; Sabin et al., 2022; Sands et al., 2023) integrates different forms of knowledge, including local and indigenous, and creates new knowledge through peer-to-peer learning and the creation of lighthouses to demonstrate good practices and solutions to inspire other practitioners. It fosters fairness and social education within (novel) networks by establishing AFNs and adopting agroecological principles and promoting new local social-ecological structures and collaborations (Vicente-Vicente et al., 2023). Food is considered a

common good within this approach and it is related to discourses on food sovereignty and the regeneration of food systems. The governance structure is horizontal and decentralized and focuses on social inclusion in local settings, thus, enabling agroecology (Vicente-Vicente et al., 2023).

## 5. Implications for science and policy

Agroecology as a term and approach is becoming more common and popular in scientific literature, as shown by our framework’s application to various examples. While this widespread use can be read as an indication of agroecology’s influence and potential as a solution to a variety of social-ecological issues, it also creates ambiguity and ambivalences in its meaning. The widespread and selective use of the term agroecology carries the risk of losing its original meaning (i.e. based on the systemic application of the principles of agroecology), and perpetuating colonial agronomy, as disputes in immaterial territories represent those in material territories (Giraldo and Rosset, 2017). Power imbalances among different contexts and knowledge systems (including natural and social sciences, academia and non-academia, and the Global South and Global North) particularly contribute to this risk. It is essential to integrate perspectives from diverse social positions, knowledge bases and realities to achieve and maintain a systemic view of agroecology.

Against this backdrop, we provide an integrative framework that builds and combines previous work to help scholars assess whether their interpretation of agroecology enables or disables transformative change in the food system. As such, the framework serves as a guiding compass rather than a precise measuring tool. Applying the framework to four agricultural approaches that have made use of the term agroecology in recent years demonstrates that not all examples labelled as agroecology are transformative or enabling. These findings align with and confirm previous research highlighting the risk of agroecology being co-opted or hijacked by actors from science and business (Alonso-Fradejas et al., 2020; Altieri and Holt-Giménez, 2016; Anderson et al., 2021; Giraldo and Rosset, 2022; Lamine et al., 2021; Rivera-Ferre, 2018; Wezel et al., 2018).

### 5.1. Discursive hijacking and common strategies

We refer to discursive hijacking (also known as linguistic or semantic co-optation) as the phenomenon whereby certain parts of a conversation or concept are extracted and used in a different context to advance certain solutions or approaches based on specific worldviews. This tactic of strategic communication redirects the topic from its original purpose towards advancing particular ideological objectives (Anderson and Anderson, 2020; Heine et al., 2017; Jensen, 2012; Knüpfer et al., 2022). Other sustainability-oriented approaches, such as sustainable bioeconomy (Vivien et al., 2019) or just transitions (Stavis et al., 2020), also demonstrate the significant semantic and practical consequences of discursive hijacking. The concept of the bioeconomy, for example, originally introduced in the 1970 s by Georgescu-Roegen as an ecological approach to theorizing economies, has been co-opted and transformed over time (Vivien et al., 2019). Current bioeconomic approaches aim to decouple economic growth from the resource base through technological fixes (e.g. Eversberg et al., 2023; Friedrich et al., 2022; Lüthmann and Vogelpohl, 2023), contradicting the original ideas and practices of the concept (Vivien et al., 2019). Similarly, the just transitions approach, which initially emerged out of working-class and union movements in response to toxic waste in their working environment, is now being mainstreamed by governments and scientists. This mainstreaming carries the risk of diluting the concept’s meaning and losing its emancipatory and transformative nature (Giraldo and Rosset, 2022; González de Molina, 2020; Stavis et al., 2020).

Discursive hijacking occurs in agroecology when certain practices or principles are chosen without considering the broader social, cultural, economic and ecological factors necessary for creating sustainable food

systems and supporting farmers. This shift in conversation veers away from the goal of establishing resilient and productive farming systems adapted to local conditions and benefiting all stakeholders. Instead, the focus narrows down to technical fixes that fail to address underlying power dynamics, perpetuate dependence on external inputs, neglect the commodification of food systems and offer simplistic solutions to complex problems (González De Molina et al., 2019; Holt-Giménez and Altieri, 2013; Levidow et al., 2014). Consequently, the original multidimensional meaning of agroecology (Wezel et al., 2009) is derailed. Different agendas, driven by alternative epistemologies such as productivity or modernization, take centre stage, diverging from the core principles of agroecology (e.g. Sullivan, 2023). This shift in focus poses risks for farmers, consumers, politicians and researchers.

While discursive hijacking is often viewed as a deliberate tactic (see Knüpfer et al., 2022), we argue that it can also occur unintentionally due to a lack of focus on or knowledge about the subject, leading to the same outcome of diverting the original agenda. However, whether the misuse of the term 'agroecology' is deliberate or inadvertent, it can have far-reaching consequences by creating confusion, misallocating resources and leading to poorly designed policies (Giraldo and Rosset, 2022; González De Molina et al., 2019). More specifically, misunderstanding in policy discussion can result in the allocation of resources to initiatives that do not genuinely align with the principles of agroecology. This misallocation can divert funds and efforts away from practices that would genuinely promote sustainable agriculture. As a consequence, policies and programs that are based on a flawed or inaccurate understanding of agroecology are likely to be poorly designed and less effective in achieving their intended goals. If policies and programs that claim to promote agroecology fail to deliver on their promises, this can result in inequitable outcomes for farmers and communities, and ultimately hindering the progress toward more sustainable and equitable agricultural systems.

We identified common strategies of discursive hijacking, including *simplification*, *false equivalence* and *confusing* or *gaslighting* the audience through our framework analysis (Fig. 4). *Simplification* involves selectively focusing on single or a few properties of agroecology, such as efficiency, input substitution or soil health, and integrating them into different topics while disregarding the broader context (see Lamine et al., 2021). This limited understanding can be seen in scientific debates on SI or CA, where specific agroecological practices are integrated into sustainable development discourses, neglecting larger societal and governance aspects. *False equivalence* occurs when unrelated or unequal issues or ideas are portrayed as the same or equally important. Technocentric approaches to CA, OF or RF, for instance, may use the term "agroecological" to describe specific management practices, replacing the original meaning of the term. This can mislead individuals into believing that practices that do not diverge from the industrial agriculture model or rely on the application of agrochemicals are synonymous with agroecology. Thus, the term agroecology is reduced to the application of some specific agricultural management practices ("agroecological practices"). A good example could be an undifferentiated consideration of CA for different kinds of farming practices for soil fertility conservation, ranging from those that use agrochemicals and heavy machinery to indigenous practices not dependent on external – industrial – inputs and based on the intensive use of traditional knowledge and human labour. The former rely on fossil fuels (generating negative environmental externalities), markets and external knowledge, and create disadvantages for small- and medium-sized farmers. The latter empower local actors and small- and medium-sized farmers, and retain socio-cultural heritage and economic performance over the long term while conserving local ecosystem services.

A third strategy involves *confusing* or *gaslighting* the audience, often intentionally manipulating information, for example, by exploiting flexible definitions, using the simplification and/or false equivalence strategies, thus adding vagueness and/or mixing different concepts (Lamine et al., 2021). This tactic is exemplified by yield- and

profit-oriented approaches found in practices such as SI, precision farming and smart farming, in which application of smart sensors and digital technologies perpetuate input dependencies and ecological modernization on large-scale farms, treating food and nature as commodities. The position paper by the International Agri-food Network (IAFN, n.d.) is a prime example for the different strategies.<sup>3</sup> In its definition of agroecology, the paper states:

*"Business is aware of three, broadly different, interpretations of agroecology today: as a scientific discipline, an agricultural practice, or as a political or social movement. We believe these multiple definitions and usages lead to confusion among scientists, policy-makers and practitioners and side tracks from the discussions on how to meet the SDGs".*

In contrast, as we argue above, a transformative agroecological approach must integrate these three dimensions as complementary rather than treating these independent. Thus, we attribute the above referenced statement to the confusion strategy. This strategy is often combined with the simplification and false equivalence strategies, as the same policy paper shows:

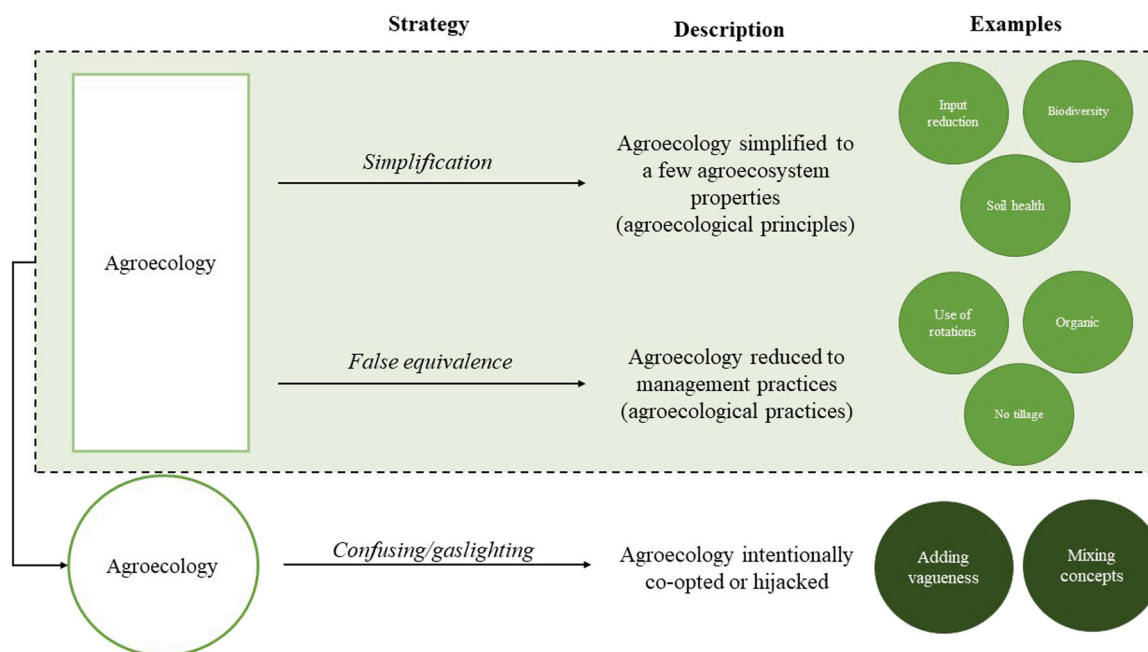
*"Many of the practices promoted under the heading 'agroecological farming' are already best practice, such as crop rotation or soil fertility management, which can be tailored and applied in a variety of contexts and farming systems whether it be organic, conventional, intensive or extensive, or integrating parts of different methodologies into one system, according to the local situation".*

The *gaslighting* strategy is used when the position paper claims that studies such as Wezel et al. (2009) or Altieri (1995) – well known for adopting a multidimensional perspective of agroecology – support their vision and statements. The overall result is to claim that there is not a consensus on what agroecology is and that there is a conflict between different views on agroecology.

Another example is shown when presenting RF as an approach close to SI and its related technologies (e.g. precision and smart farming). These examples contradict or oppose agroecology (Pimbert, 2017; Sullivan, 2023) and overlook the socio-political dimension of agroecology and its transformative potential for creating just and sustainable agri-food systems (McGreevy et al., 2022). Newton et al. (2020) found that the "term 'agroecological farming' [is] commonly used synonymously with, or adjacently to, the term 'regenerative agriculture'". We attribute this to the false equivalence or simplification strategy. RF and agroecology conflated are conflated, probably unintentionally and possibly because RF lacks a clear definition and has some overlap with agroecological practices and principles.

However, in the last few years RF has been linked to C farming and net-zero goals, usually related to C offsetting pledges (e.g., Corteva Agriscience, 2021; Nestlé, 2023) in a commodification approach. A clear example in the scientific literature is Qian et al. (2022), who assess C emission targets of the company PepsiCo. This is indeed a general trend, which can be found in documents from different companies and lobby groups, where agroecology is mentioned as part of a strategy of mixing different concepts and approaches. These different approaches can also be found in the reports with different terms and under the umbrella of other broader approaches such as "nature-positive", as well as by using new terms that are comprised within the selected four ones. For instance, although the "nature-based solutions" term is commonly mentioned in these reports, this approach comprises other ones (e.g. Net Zero, C farming and soil C offset credits, Climate-Smart Agriculture) that we have already included within RF, which was split into three different approaches. Similarly other ones have been included in the CA (e.g. no-till agriculture), OF (split into two different approaches) and SI (e.g. precision farming and big data). These discourses often deploy a

<sup>3</sup> This is not an isolated example but a trend in the IAFN. Many other similar examples can be found on its website (IAFN, 2020)



**Fig. 4.** Summary of the three strategies identified as discursive hijacking in agroecology. Although discursive hijacking can be found in the three of them, it is only the third one, where the simplification and false equivalence strategies are intentionally used to confuse, implying a hijacking of the term agroecology. This strategy is used in SI and the commodification approach of RF.

disabling agroecology approach, by proposing socio-technical innovations (digital and breeding technologies) that focus on maximizing yields while increasing dependence of farmers from external inputs, similar to the SI approach (Bayer, 2023; CropLife, 2023; Syngenta, n.d.; Yara International, 2023).

Innovative technologies can enhance both incremental and systemic innovations efficiently in certain situations. However, they are not a crucial component of agroecological transformation on their own. It is vital to distinguish whether these innovations merely support some agroecological principles or enable the entire agroecological system to function. To do this, preconditions need to be considered and a systemic agroecological approach must be pursued. For example, organic farming's success depends on implementing functional principles, but it has required certification for mainstreaming and EU funding. Current policy efforts aim to promote agroecological transformation, emphasizing the co-creation of territorially adapted pathways. A focus on designing systemic and territorially adapted intervention strategies, leveraging existing resources, and developing performance indicators and metrics, is key, but currently lacking (Faure, 2021). Our framework aims to contribute to this gap.

The widespread and flexible use of the term agroecology, regardless of intentional or unintentional discursive hijacking, leads to confusion, delusion and misuse. This creates difficulties for genuine agroecology practitioners in effectively conveying their ideas in policy arenas. Current trends, such as SI and the RF commodification approach, erode the original meaning of agroecology, undermining its focus on social justice and the transformative capacity for sustainable agri-food systems. In the end, discursive hijacking obstructs productive communication, hindering meaningful dialogue and consensus-building. Therefore, it is crucial to urgently implement measures to prevent the discursive hijacking of agroecology.

## 5.2. Preventing hijacking through knowledge co-creation and sharing in practice, science and policy

The discursive hijacking of agroecology cannot always be prevented, but different types of misuse can be addressed through knowledge co-creation and sharing between practice, science and policy to ensure

agroecology remains transformative for agri-food systems towards social-ecological sustainability. A co-creation approach to knowledge considers the perspectives of systems and questions the commodification of food systems, or at least does not implicitly legitimize commodification (González De Molina et al., 2019; Levidow et al., 2014). A link between co-creation and de-commodification processes in agroecology is that they share the goal of transforming the food system sustainably, equitably and resiliently. However, this involves rethinking principles and practices for knowledge co-creation and validation, and sharing and aligning them with the principles of agroecology.

Experiences and lessons from participatory action research worldwide highlight the importance of starting knowledge co-production and dissemination through territorial or place-based approaches as a critical step in scaling up transformations at larger scales (Bottazzi and Boillat, 2021; Giambartolomei et al., 2021; Vicente-Vicente et al., 2023). Place-based approaches consider the unique context, characteristics, needs and assets of a particular place or community when designing and organizing agri-food systems (Coulson and Sonnino, 2019). In order to do so, place-based approaches seek to engage territorial actors from practice, science and policy to combine, co-create and share knowledge for managing the local agroecosystem (Klebl et al., 2022; Vicente-Vicente et al., 2023). Here, the agroecosystem is conceptualized as a space of interaction between productive areas and broader social-ecological systems from a larger territorial perspective (Bottazzi and Boillat, 2021). The concept involves the collaborative development of "experimental territories in transition" (Bottazzi and Boillat, 2021) where grassroots agroecological innovations are introduced and deliberated upon by a diverse group of practitioners, researchers, and policymakers.

Place-based co-creation of knowledge would include, for example, the active participation and collaboration among various stakeholders (e.g. farmers, consumers, researchers, policymakers and civil society organizations) to address social-ecological issues in agriculture, which are characterized by subjectivity, normativity, ambiguity and uncertainty. The integration of diverse types of knowledge from various social actors (e.g., in a post-normal paradigm, see Funtowicz and Ravetz, 1994) in agroecological approaches is crucial to address these "wicked problems" (Peters and Pierre, 2014; Termeer et al., 2019; van Bers et al.,

2019). This includes recognizing and including knowledge from different social positions, interests and epistemologies, such as local traditional and indigenous knowledge that brings valuable ecological and socio-economic perspectives, but is often marginalized in academic or political debates (Cebrián-Piqueras et al., 2020; López-Rodríguez et al., 2020; Vijayan et al., 2022). Focusing solely on evidence from natural sciences and exclusively on on-farm processes, while neglecting other sources and forms of knowledge, limits our understanding of the complex challenges within food systems and hinders transformative opportunities. When based on public-private partnerships, for example, co-creation has the potential to leverage public and private resources and expertise to address sustainability challenges. However, careful attention and a commitment to agroecological principles (e.g. prioritizing the well-being of farmers, communities and ecosystems over profit-driven models, ensuring fair distribution of benefits and upholding democratic governance mechanisms) is required to prevent continuous commodification processes. By engaging a wide range of actors, knowledge, and commitments, co-creation facilitates context-specific, participatory and socially just decisions and actions in shaping agri-food systems.

Creating platforms for dialogue, horizontal networks and collaboration among agroecology practitioners, farmers, policymakers, researchers and others are vital to foster a shared understanding of agroecology and enable an approach of agroecology that can contribute towards just, sustainable food systems (Utter et al., 2021; Wezel et al., 2018). The agroecology and organic movements, for example, could work together as partners to transform farming and food systems (e.g. the Spanish Society on Organic Farming and Agroecology (SEAE, n.d.)), as agroecology provides essential concepts for sustainable agricultural practices (IFOAM, 2019).<sup>4</sup> Here, actors at the science-policy interface can play a role in strengthening and governing these alliances by facilitating multi-stakeholder engagements and public-community partnerships, building relationships among research groups even across continents (López-Rodríguez, 2016). This, in turn, could support the representation of marginalized agroecological knowledge and practices in policies (Vijayan et al., 2022). In these processes, it is crucial to critically evaluate the stance of participating actors regarding agroecological transformations, and set multilevel food governance instruments as politicized spaces (Duncan and Claeys, 2018) that privilege local actors committed to sustainable food security (Marsden et al., 2018; Sonnino et al., 2014).

It is also necessary to avoid “blur[ring] the lines between the roles and responsibilities of rights holders, duty bearers (i.e., states as the upholders of those rights), and those acting on behalf of corporate agendas” (IPES-Food, 2023, p. 15). Actors prioritizing private aims – as groups of interest – should not hold equal value as social groups depending directly on food for their livelihoods – subjects of right to food – and the access of the former to decision-making spaces should be limited, as their interests may perpetuate the commodification of food systems. The power imbalance of interest holders thus amplifies the unsustainability and inequity of agri-food systems (De Schutter et al., 2018; Duncan and Claeys, 2018; González de Molina et al., 2019; Guzmán et al., 2022). For example, the “multi-stakeholder” approach during the UN Food Systems Summit in 2021 prioritized the interests of corporations, which led agroecology organizations to withdraw from the process (Canfield et al., 2021; Fakhri, 2022; Gliessman and de Wit Montenegro, 2021).

In opposition to this approach, engaging in *diálogos* and *ecologías de saberes* (Engl. dialogues and ecologies of knowledge), where farmers, scientists, public actors and community members share knowledge and experiences, also recognizing knowledge as something to be mediated

by non-human actors (Salas, 2013; Star, 1995) is crucial. This facilitates: 1) the integration of local and scientific knowledge, 2) co-creation of new knowledge, and 3) capacity building for agroecology (Giraldo and Rosset, 2022; Vivo Cuenca, 2022). The co-production of knowledge extends beyond its creation and runs along the performative construction of social, collective subjects and alliances (López-García et al., 2021; Méndez et al., 2017). A comprehensive approach considering social, economic and environmental dimensions is crucial to quantify, communicate and disseminate evidence of agroecological practices. Methods and tools, such as the Agroecology Criteria Tool, based on applying 62 criteria aimed at assessing whether a project or initiative supports the agroecological transition (Biovision, 2019a), have been developed and tested in various contexts (Biovision, 2019b; Vicente-Vicente et al., 2023) and can provide guidance.

To transition agri-food systems towards agroecology it is essential to extend governance structures beyond the farm level to the landscape or territorial scale. This expansion requires the promotion of collective efforts and the gradual implementation of decentralized governance mechanisms which can be cross-sectoral and multi-level in nature. The risk of discursive hijacking can be minimized by using such an approach of “mainstreaming agroecology” in multilevel agri-food policies (López-García and Carrascosa-García, 2023) beyond false equivalences, while preserving the deep social-ecological sustainability potential of agroecology. In this context, multilevel state administrations can play a crucial role by recognizing agroecology as a legitimate agricultural approach and supporting practices in line with its principles, avoiding practices of simplification or false equivalence, as has happened in some national political frameworks in Europe and Latin America (Ajates Gonzalez et al., 2018; Giraldo and McCune, 2019). However, there is significant controversy regarding the specific activities that policies should encourage to promote agroecological transformation. In the context of the EU Farm to Fork strategy, Faure (2021) discusses key elements of this debate, such as systemic innovation, performance metrics, genetic progress, digital tools, farm and value chain structures, and actor mobilization. The author concludes that it’s important to adapt known intervention types to align with agroecological systems thinking, considering social and environmental responsibility, and fostering the co-development of local and scientific knowledge for appropriate transformation pathways. Meanwhile, state authorities can remove regulatory and legislative obstacles, create an enabling environment for the systemic application of agroecology, and implement policies that prioritize agroecological farmers and communities while protecting land, water, seed and other resources from speculation and commodification (Anderson et al., 2019a; González De Molina et al., 2019).

For knowledge dissemination, awareness-raising campaigns and educational programmes can promote a better understanding of agroecology, its principles and its implications. Governments can play a role here by incorporating agroecology into national development plans, providing public funds for research and education programmes (González De Molina et al., 2019; PP-AL, 2017), introducing policy reforms to promote an administrative environment and subsidies favourable to holistic, highly diverse agroecological farming models, and preventing disabling incentives (González De Molina et al., 2019; López-García and Carrascosa-García, 2023), supporting the dissemination of agroecological knowledge through investments, training and technical assistance, and creating market opportunities for agroecology-oriented farms (Giraldo and Rosset, 2022; Mier y Terán Giménez Cacho et al., 2018). Dissemination efforts can also utilize diverse formats, including infographics (CIDSE, 2018) or movies (Seeds of Change, 2023), to reach a wide audience. Fostering the co-creation and dissemination of agroecological knowledge and practices, participatory and bottom-up processes, such as dialogues between actors, should be integrated into the support and planning of agroecology initiatives (Giraldo and Rosset, 2022; Méndez et al., 2017). Finally, agroecological lighthouses that demonstrate good practices (Vicente-Vicente

<sup>4</sup> The German protest “We are fed up” can be viewed as a bridging movement as it included calls for small-scale organic and agroecological transitions (Nowack and Hoffmann, 2020).

et al., 2023) are potential ways to scale local co-created knowledge and agroecological innovations to higher governance levels (e.g. at national or international levels).

### 5.3. Reflections and limitations

We have applied our framework exemplarily to four approaches based on selective sources. Therefore, one should read our application and characterization of these approaches as a reference to the sources used. If other sources are examined, one might encounter different interpretations of their use of agroecology. Hence, we encourage scholars to conduct case studies on approaches, farming systems and narratives that refer to the term agroecology and build on our framework to assess whether the interpretation of agroecology is transformative in these specific cases. This also accounts especially for practical implementations of the approaches with which we have illustrated our application, namely, SI, CA, OF and RF. Alternatively, the framework could be applied to other cases that go beyond farming practices, such as AFNs including community-supported agriculture or food hubs at urban-rural interfaces, which bring together diverse actors and practices across the food system (Klebl et al., 2022; Vicente-Vicente et al., 2023). As our research shows, the context (especially taking a systemic perspective that includes up- and downstream actors) matters in terms of characterizing these approaches as enabling or disabling agroecology. In addition, we urge scholars to review our framework critically and develop it further, especially concerning the practical implementation as a guiding tool in research on approaches that use the term “agroecology” (e.g., Prost et al. 2023). We also particularly encourage agroecological activists, researchers and practitioners to critically evaluate our framework and the idea behind it to reflect on it from different perspectives and positionalities in society. In our view, this will promote the decolonization of knowledge production, the protection of local practices and agroecological knowledge.

## 6. Conclusion

The conceptual evolution and heterogeneous usage of the term “agroecology” shapes the risk of agroecology being hijacked and emptied of its transformative potential. It could be argued that its wide and diverse use refers to the linguistic evolution of terms and approaches in a general sense. We recognize that this process is not always intentional, often driven by well-intentioned meanings to promote agroecology, which is usually the case in CA, OF and the agronomic approach of RF. We have proposed an integrative framework as a guiding tool to distinguish between different meanings and uses of agroecology and to better understand the different notions and concepts. The framework builds on previous work and is structured along seven domains of transformative agroecology: (i) rights and access to nature, ii) knowledge and culture, iii) systems of economic exchange, iv) networks, v) equity vi) discourses and vii) governance) and their effects on the overall agri-food system, ranging from transformation to preserving system stability. We applied our framework to illustrative examples that have made use of the term agroecology in recent years, namely SI, CA, OF and RF.

The application shows that SI and the commodification approach of RF currently lack emphasis on social and political elements, thus eroding the original meaning of agroecology, its emancipatory idea of social justice and transformative capacity towards more sustainable agri-food systems. CA performed well in the areas of soil management and agroecosystem management domains, but allowed the use of unsustainable inputs and had limited transformative potential owing to the lack of a systems perspective. Conversely, approaching RF with attention to social-ecological issues can be seen as a best practice of how agroecological knowledge can be used without co-opting the concept. However, we have identified several discursive mechanisms that hijack the term “agroecology” from its transformative, social-ecological sustainability

potential, namely, simplification, false equivalences and confusing/gaslighting. Hijacking/co-optation often underlies this confusing/gaslighting strategy, which we attribute to the SI and commodification approach of RF. In some cases, this is done by linking discourses on digitalisation in precision and smart farming, while in other cases the commodification occurs when RF is used to increase profits through C farming and C credits.

In brief, without integrating agroecological essentials, such as social justice, taking a systemic (i.e. social-ecological) approach and referring to the de-commodification of food systems, an approach cannot call itself agroecological based on our framework. Agroecological networks have shown that strengthening communication and networks, adapting regulatory frameworks, and creating enabling conditions can generate interest and inspire people to self-organize for building more sustainable, just and resilient agri-food systems. Moreover, it is important to build on diverse knowledges, compelling evidence and the recognition of the transformative value of agroecology. Therefore, preventing discursive hijacking of agroecology requires a combination of education, collaboration, accountability, policy and regulatory efforts to protect the integrity of the term and the principles it represents.

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## CRedit authorship contribution statement

**Daniel López-García:** Writing – original draft, Writing – review & editing, Conceptualization. **José Luis Vicente-Vicente:** Conceptualization, Formal analysis, Investigation, Methodology, Visualization, Writing – original draft, Writing – review & editing. **Annette Piore:** Writing – original draft, Writing – review & editing, Validation. **Jonathan Friedrich:** Conceptualization, Writing – original draft, Writing – review & editing, Methodology. **Beatrice Walthall:** Conceptualization, Formal analysis, Investigation, Methodology, Project administration, Visualization, Writing – original draft, Writing – review & editing.

## Declaration of Competing Interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Beatrice Walthall reports financial support was provided by European Commission.

## Data Availability

No data was used for the research described in the article.

## Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at [doi:10.1016/j.envsci.2024.103748](https://doi.org/10.1016/j.envsci.2024.103748).

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