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To cite this article: Francisco Javier Espinosa-García, Erick de la Barrera & Alba González Jácome (2024) The conceptual babel of agroecologies is related to their diverse origins and objectives, *Agroecology and Sustainable Food Systems*, 48:1, 4-16, DOI: [10.1080/21683565.2023.2270938](https://doi.org/10.1080/21683565.2023.2270938)

To link to this article: <https://doi.org/10.1080/21683565.2023.2270938>



Published online: 23 Nov 2023.



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The conceptual babel of agroecologies is related to their diverse origins and objectives

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ABSTRACT

The term agroecology has undergone broad diversification since it was first conceived as the study of the ecology of agricultural systems. In addition to the “tripartite” definition, which includes science, practice, and social movement, political and “emancipatory” agroecologies, among others, are included. There is no consensus on the meaning of “agroecology” and “agroecological,” nor the objectives and uses associated with those concepts. Thus, despite the concept of “agroecology” not being consolidated nor unisemic, its meaning and application continue to diversify according to the interests and perspectives of the users. That diversification encompasses different ways of looking at agriculture’s role in human societies and the environment in which they are based and function. Agroecology, too, has been seen as an activity whose objectives include issues as diverse as mythical, ceremonial, dogmatic, political, or religious. Moreover, this unrestricted diversification also devalues and trivializes the term and hinders the mutual understanding among academics, practitioners, promoters, decision-makers, the public, and government agencies. We begin a series of reflections on the various agroecologies in Mexico that we hope will promote the formation of clear, well-defined, and documented concepts to contribute to synergies among agroecologies and the advancement of their objectives.

KEYWORDS

Conceptual confusion;
conceptual diversification;
sustainable agriculture;
scientific agroecology;
technological agroecology

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[§]A preliminary version of this paper was presented at the First Mexican Congress on Agroecology in San Cristóbal de las Casas, Chiapas. May 2019, and was included without our consent in the non-peer-reviewed proceedings of that congress: Espinosa-García, F.J.; de la Barrera, E. y González Jácome, A. (2022). Historia y desarrollo de la agroecología en México. La babel conceptual de las agroecologías está relacionada con sus orígenes diversos. In: C. Elizondo, López Merlín, D. Vázquez G. A. eds. Agroecología en México, soberanía alimentaria, saberes, cosmovisión y patrimonio biocultural. Conocimiento, práctica, movimiento y corazón. Tomo I. Pp. 9–13. San Cristóbal de Las Casas, Chiapas, México; Editorial Chiapaneros, Sociedad Mexicana de Agroecología.



Introduction

The term agroecology has undergone extensive diversification since it was first conceived as the study of the ecology of agricultural systems (Bensin, cited in Wezel et al. 2009). Currently, in addition to the “tripartite” definition of agroecology of Wezel et al. (2009), which includes science, practice, and social movement, political agroecology (Rosset and Altieri 2019), historical agroecology (Rivera-Nuñez et al. 2020), “emancipatory” (Giraldo and Rosset 2021) and transformative agroecologies (Guzmán Luna et al. 2022) are proposed. As an example of conceptual diversification, the tripartite vision has been taken to the extreme of considering the agroecologies identified by Wezel et al. as an “agroecological holy trinity,” in which each agroecology is distinct and, at the same time, one (Toledo and Barrera-Bassols 2017). Following this vein of spirituality, Toledo (2022) also proposes that agroecology and spirituality are linked, which could lead to a new agroecological religion based on the sacralization of the “Pacha Mama” or Mother Earth (Toledo 2022).

Agroecology has also been seen as an activity whose objectives – besides providing food and fiber – include others, which may be mythical, ceremonial, dogmatic, political, or religious. It may be that agroecologies ignore their central objective, becoming an ineffective instrument in food matters, including its production, circulation, and distribution. That does not mean that agriculture is not linked to various human activities at different times, internal and external events, at different scales, starting with the family and local economy.

Some authors accept the tripartite version of Wezel et al. (2009) and describe the development of the three agroecologies, as it occurs in Mexico (Astier et al. 2017). However, far from being a consolidated concept (Gallardo-López et al. 2018), the diversification of agroecologies has been extended to recognize intercultural agroecologies (Rosado-May 2021), which are essentially local, elaborated on the specific needs of groups of stakeholders who want to modify the agriculture conditions in their places of residence

(González Jácome 2022). On the other hand, Giraldo and Rosset (2021), in addition to denominating new agroecologies depending on whether they have been institutionalized (co-opted), have qualified them as “false” (such as “neoliberal” or “reformist”) or “true” (such as “popular agroecology” that derives in “emancipatory agroecologies”).

The term agroecology has spread among academics, peasants, environmentalists, scientists, agronomists, educators, and diverse social activists. Also, the term has permeated international organizations, such as the UN and FAO, where it is considered key to sustainable rural development (González Giraldo and Rosset 2018; Wezel et al. 2020). Moreover, some of its promoters consider agroecology as a new revolution that will lead countries to food self-sufficiency and food sovereignty (Altieri and Toledo 2011) and even to “emancipation” (Giraldo and Rosset 2021).

The big question is, do all those who use, embrace, promote, defend or attack “agroecology” have the same concept? The answer is no, even though several authors of the multiple self-styled agroecological movements implicitly assume that the concept of agroecology is unisemic and consolidated, as is the body of scientific and technological knowledge that defines agroecologies (Holt-Giménez and Altieri 2013; Rosset and Altieri 2019). Other authors claim that agroecologies or “agroecological perspectives” are clearly delimited, rejecting the depiction of agroecologies as confusing (Méndez, Bacon, and Cohen 2013). On the contrary, we argue that the diversification of the meaning of “agroecology” continues; for example, agroecology can now also be recognized as an ideology for a sustainable way of life (see Wezel et al. 2020).

The application of the words “agroecology” and “agroecological” is also diversified. Those words can be found as a reference to natural and social sciences research, a synonym for rural development or adoption and application of productive techniques, or to refer to products or attitudes related to sustainable agroecosystems (Espinosa-García et al. 2019). In most cases, the various meanings and uses do not have a consolidated scientific and technological basis.

The diversification of the concept “agroecology” and its uses causes all those who call themselves agroecologists (scientists, agronomists, practitioners, promoters, activists, or users of an agroecological concept) to attribute diverse purposes, uses, and meanings to agroecology; this causes all stakeholders to be in a conceptual Babel speaking different “languages,” which hinders mutual understanding and the synergies among practitioners and those affected by agroecologies. Another consequence of the conceptual confusion about the term “agroecology” is that the public does not understand what agroecologists are referring to, so the word is devalued (as in the case of the adjective “ecological” that came to be applied indiscriminately to objects, vehicles, exterior paint, political parties or commercial products). Another concept that underwent a process of diversification, confusion, and devaluation was

that of sustainable development, which came to have more than 70 meanings in the year 2000 (Meadows 2000, cited in Jetzkowitz 2019).

In this essay, we want to contribute to the delimitation of agroecologies by examining their scientific and technological foundations and the definitions self-stated or inferred from the publications that propose them. Delimitation can help reduce or avoid conceptual confusion, avoid potential confrontations, and identify possibilities for synergies among agroecologies.

The diverse agroecologies

One of the conceptual axes that should articulate agroecologies is sustainability, that is, sustainable agriculture that is simultaneously environmentally friendly, socially just, and economically beneficial (Wezel et al. 2014). However, sustainability is not necessarily a goal sought by agroecological movements dealing with preserving cultures, territories, livelihoods, and ways of life, revalorizing repressed or marginalized social groups, and political agroecology, which seeks change in power relations. Those movements validly seek justice, respect, autonomy, and recognition of their existence and rights. Sustainability would be sought after the movements' demands or the change of power relations have been achieved. Thus, some of those movements use agroecology as a banner or to validate their movements. Possibly using the term "sustainable agriculture" or searching for a sustainable society or development would be more appropriate to flag those movements.

Another integrating element of agroecologies is the agroecosystem. The agroecosystems result from the practice of agriculture, and they are as varied as the cultures of the people who design, manage and benefit from them in biotic and abiotic environments characteristic of each locality where plants are cultivated, and domesticated animals are raised (González Jácome 2011, 2022; González-Jácome 2019). For some agroecologies, agroecosystems are objects of study or construction; for others, sustainable agroecosystems are the basis of farmers' livelihoods and sustainable food systems; for others, they are instruments for political and social change (Rosset and Altieri 2019).

Scientific agroecologies

Scientific agroecologies (broadly divided into natural science agroecology, social science agroecology, and integral scientific interdisciplinary agroecology) have the proximate purpose of generating, accumulating, and systematizing scientific knowledge of the nature and functioning of all types of agroecosystems; their ultimate aim is to contribute to the sustainability of agricultural systems and agri-food systems through the knowledge generated and its conceptual and technological application. Both goals are achieved through understanding

nature in natural and anthropized environments and human cultures in natural and anthropized environments, whether sustainable or not.

Understanding is embodied in scientific knowledge (which by nature is falsifiable, i.e., it can be tested to see if it is true or false, and the route to obtaining knowledge is repeatable); that results in general principles, which in turn give rise to technologies that require adjustments to local conditions to achieve sustainability. Scientific agroecologies derive their knowledge from the progress of their scientific disciplines of origin, based on the study of natural ecosystems, societies, and cultures in general, and from the traditional knowledge that sustains the diverse lineages of traditional agriculture and its transformations (González Jácome 2011), some of which have led to conventional or industrial agriculture and mixtures between both models of agricultural production, distribution and consumption.

Technological or practical agroecologies

Practical agroecologies seek sustainable agroecosystems, but they require scientific agroecological principles and the knowledge of the local people of the environment where the production units will be implemented and the people who will consume or use these products. Also, the practical agroecologies need to know the market where they will sell the agroecosystem surpluses. Local knowledge can come from traditional farming communities, which could also provide domesticated species and the knowledge for their management (González Jácome 2022). If this is impossible, this knowledge must be generated as a prerequisite for implementing the practice; this is where agroecology must be interdisciplinary or transdisciplinary through participative action-oriented research (Mendez et al. 2013). The agroecological principles may be applied in conventional agroecosystems to be converted to sustainable agroecosystems, in rescuing traditional agroecosystems that have been abandoned or deteriorated, or in the creation of new agroecosystems (Wezel et al. 2020). In any case, the adaptation of production practices will require adaptive management, in which practical experience, local and scientific knowledge, and farmer culture combine to guide ecological, economic, social, and cultural adaptation to the ever-changing conditions of agroecosystems and people living within them (Mendez et al. 2012; Gómez Martínez, Mata García, and González Santiago 2017; González Jácome 2022).

Practical agroecologies can be grouped into two categories, one that represents a *livelihood* that guarantees well-being, stability, and security in the face of risks; and another that represents a *way of life* that, in addition to what the livelihood seeks, is accompanied by principles and values congruent with the harmonious coexistence of humans with each other and with nature through sustainable agri-food systems. Recently, there's also been discussion about the distance from which food is produced, traveled to different places in the world,

and distributed to local and regional locations far from the human populations that were the agro-producers.

The *livelihood* category seeks to take advantage of the growing demand for organic products and their higher price than conventional products. An example of agroecological practice as a livelihood is organic agriculture or other alternative agriculture that produces without the use of synthetic agrochemicals (fertilizers and pesticides). Some authors denounce those alternative agricultures as non-agroecological because they depend on inputs external to the producers' agroecosystems (Rosset and Altieri 2019). However, we consider that vision that is purist and excludes alternatives that contribute to sustainability by reducing some adverse impacts of agriculture and livestock farming. In addition, alternative agriculture reduces human impact on ecosystems and climate (Wilk 2009, 265–276), which would be a significant advance if this reduction could be applied to industrial agriculture.

In addition to integrating agroecological practice, *the way of life* category is also a movement to produce a sustainable society through sustainable agri-food systems aided by “transformative” agroecology (Guzmán Luna et al. 2022). The best representative of this agroecological practice and movement is the one represented by Prof. Stephen Gliessman (2015). Besides resisting the onslaught of those who promote and benefit from intensive conventional agriculture, it persists in achieving sustainable agri-food systems. In addition, they also propose and research the conversion of conventional agroecosystems to sustainable agroecosystems. This agroecological approach connects the need to integrate sustainable agriculture with the reduction of air, water, and soil pollution; to achieve a food supply that reduces the problems of diseases generated by the consumption of food products contaminated by pesticides and harmful industrialized products and their packaging systems. It also seeks to achieve economic and commercial systems where small and medium-scale farmers receive what their products are worth (exchange value and fair trade) for all that they invest in agricultural production without deteriorating the environment and agroecosystems.

Agroecological principles

Scientific agroecologies and agroecological practice have generated ecological principles common in sustainable agroecosystems and many agricultural practices compatible with sustainability (Altieri 2002; Gliessman 2015; Wezel et al. 2014; Guzmán Luna et al. 2022; Wezel et al. 2020). However, that theoretical and practical knowledge still needs to be much improved to manage or adjust the enormous diversity of agroecosystems and the landscapes where they are found, including their heterogeneous biotic, abiotic, and anthropogenic conditions. Ecological knowledge associated with sustainable agroecosystems is still incipient or absent in several aspects, for example,

cultivated holobionts¹ (see Berlanga-Clavero et al. 2020), edaphic and aerial biological interaction networks, holobionts of non-cultivated plants, knowledge of the processes of continuous domestication, the ecology of landscapes in which agroforestry systems are inserted, agroecosystems and natural ecosystems, or the resilience and stability of agroecosystems in the face of climate change and invasive species. In addition, the economic policies of the countries involved must be taken into account.

The social, economic, and cultural principles that could be common to all sustainable agroecosystems are grouped in the protection or promotion of the cultural nuclei of farming communities. In human societies, the cultural nucleus functions as an integrator of the components of agroecosystems, including environmental, economic, agricultural, and non-agricultural components associated with the functioning of the family and its integration into an agricultural society (González Jácome 2022; Guzmán Luna et al. 2022). For example, this includes commercial activities, handicrafts, hunting, fishing and gathering, and salaried work inside and outside the communities, including migrants and their remittances (Wilk 1997, 2009).

That cultural core underlies all functional agroecosystems, although they are susceptible to external economic forces, policies, and global change. Several factors erode the integrity of the interrelationships among the components of agroecosystems, which may lead to their extinction. As examples, there are the extinct agroecosystems of the Papaloapan basin, those of the Toluca Valley, and the chinampas of the Valley of Mexico (Aguirre Beltrán 2008 [1950]; Aréchiga-Córdoba 2011; González Jácome 2022; González-Jácome and Velasco Orozco 2008, 2015).

Other social, economic, and cultural principles based on scientific observation and analysis, which could be shared in every sustainable agroecosystem, still need to be consolidated partly because of the different perspectives of analysis and approaches that divide sociologists (Jetzkowitz 2019). For example, the so-called “social principles of emancipatory agroecologies” (Giraldo and Rosset 2021) are a set of behavioral and perspectival maxims designed as ideological support for “building truly transformative and revolutionary agroecological processes.” However, those principles need scientific bases to evaluate their generality and support their ideology with factual information.

Agroecological movements

Agroecology as a movement (Wezel et al. 2009) encompasses many social movements with different philosophies, ideologies, objectives, methods, and perspectives, as discussed throughout this essay. Various types of leadership accompany this diversification. Theoretical academics spawned some movements, others by academics with fieldwork, and others by diverse leaders or social activists with substantial local

influence. Another common aspect of many agroecological movements is that they originated in opposition to the prevailing corporate agri-food systems and the power structures that sustain them (see Giraldo and Rosset 2021).

Most social movements and political and popular agroecologies do not define the concept of agroecology that they use as a foundation or banner. However, they implicitly presume that their agroecologies are shaped by ecological principles based on scientific, empirical, and traditional knowledge associated with agroecosystems that tend toward sustainability. They also implicitly and incorrectly assume that these principles and knowledge are complete and can be applied in any agroecosystem or region. Some theorists of political or popular agroecology consider that these agroecological principles and knowledge should be defended from attempts to appropriate (or co-opt) “agroecology” by large agri-food corporations, governmental institutions, or international organizations (see Bejarano 2017; Giraldo and Rosset 2021).

The term “agroecological” can be abused just as has been the term “ecological,” but any person with critical thought can detect the possible deceptions associated with the misuse of the terms. Similarly, the implementation of some practices associated with sustainability by corporations or institutions does not imply that the rest of their practices are sustainable. Those organizations may co-opt scientists, practitioners, or people who call themselves agroecologists, but the appropriation of scientific and traditional agroecological knowledge can hardly be achieved. Thus, Manichean approaches in the classification of agroecology or the practice of agroecology are much less fruitful than scientific and critical education in the construction of sustainable agroecosystems or those that tend to sustainability.

Manicheism is evident in some ideologues of agroecological movements, who think that agroecological sciences and practices should be at the exclusive service of social groups dispossessed or assaulted by “savage capitalism” or “neoliberalism” (Giraldo and Rosset 2018, 2021; Holt-Giménez and Altieri 2013). Those ideologues disqualify the study of conventional agroecosystems despite the heuristic capacity of those studies that can be used to document the conditions under which agroecosystem deterioration occurs and consequently to design sustainable alternatives or those with much less impact on societies and ecosystems. The ideologues of these movements also categorically reject the incorporation of technological developments such as genetically modified crops, even if they are improvements in food quality of crops or resistance to drought or pests achieved through the manipulation of the crop genome itself (Wei et al. 2022). The outright rejection of technologies associated with the new green revolution is due to the repudiation of the so-called “neoliberal global food corporate governance” (Holt-Giménez and Altieri 2013). Several movements confuse the voracity and abusive (and even perverse) practices of

transnational agribusiness and agrochemical companies with the objective evaluation of novel technologies' potential benefits and harms.

An always latent problem is constituted by local and regional issues that establish similarities and differences between the components of agroecosystems that may seem similar at first glance, but that respond to different situations of historical trajectories, physiographic, altitudinal, landscape and ecosystem conditions; additionally, they respond to the educational status, social organization and cultures of the human groups established in specific regions. These agroecosystems cannot be treated in the same way. In fact, specific studies are needed to clarify the local or regional problems under discussion. Instead of Manicheism, agroecologies should be helpful for all agricultural systems, especially to maintain, improve and move toward sustainability in our agri-food systems.

Concluding remarks

The previous brief analysis shows that each of the multiple agroecologies has different concepts, objectives, and methods. The various agroecologies are neither equal nor equivalent. Thus, the trinitarian concept of Toledo and Barrera-Bassols (2017) is not sustained by the divergence in concepts, objectives, and methods of the agroecologies. Each agroecology has its work, perspective, objectives, the scope of action, and methods that do not necessarily encourage cooperation or could even lead to confrontation.

The agroecologies and agroecologists should consider, or at least discuss, the application of essential aspects that several scientists (e.g. Guzmán Luna et al. 2022; Wezel et al. 2020) and institutions such as the Colegio de Posgraduados and XXX, have considered, which are summarized as follows: (1) the need to integrate a high level of knowledge generated in universities into their proposals and research centers and institutes; (2) Include traditional local agricultural knowledge in their studies, analyses, and proposals; (3) Seek food security; (4) Use appropriate technologies; (5) Seek social health; (6) Provide and contribute to the population's access to quality formal education; (7) Improve the quality of life of human populations, considering their ideas in this regard; (8) Use of renewable energy resources; (9) Environmental restoration and conservation of natural resources; (10) The construction of new options for alternative systems based on studies of traditional agriculture; (11) Find solutions to the lack of continuity in the arrangements between local, national, and international institutions; (12) Find solutions to close the short-term and long-term development gap; (13) Shorten the distance between scientific and agroecological knowledge with the technological needs linked to the processes required by companies to achieve reductions in adverse environmental and climatic impacts on life on the planet; and (14) Seek how to generate economic

profits for companies and at the same time support social development and fair trade (Academy of Sciences, New York 1996; FAO 2006, 2014; Gliessman 2015; González-Jácome 2019, 269–296).

We propose to move away from dogmatism and allow synergies between agroecologies by promoting a common language, knowledge, and respectful management of the objectives and methods of agroecologies and their practitioners. By promoting knowledge among agroecologies and moving away from the imposition of should-be or objectives on other agroecologies, we can foster (a) the exchange of knowledge, methods, joint research, and technology transfer among practitioners of non-conventional agriculture; (b) the transfer of agroecological principles to farmers in the process of converting their agroecosystems to have a lower impact, or better yet, to build sustainable agroecological systems functioning in sustainable agri-food systems. We hope this essay promotes the formation of clear, well-delimited, and documented concepts in all practitioners of agroecologies.

Note

1. The plant holobiont is the set of micro- and macroorganisms symbiotically associated with a plant. All those organisms and the plant establish networks of biological interactions.

Acknowledgments

This work was supported by the Instituto de Investigaciones en Ecosistemas y Sustentabilidad-UNAM under Grants IIESPO-FJEG; IIESPO-EBM.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

The work was supported by the Universidad Nacional Autónoma de México IIES [IIES-POFJEG]; Universidad Nacional Autónoma de México, IIES [IIES-POEBM].

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