Measuring agroecology and its performance: An overview and critical discussion of existing tools and approaches

Article *in* Outlook on Agriculture · August 2023

DOI: 10.1177/00307270231196309

CITATIONS
8

READS
1,533

3 authors, including:

Matthias S Geck
World Agroforestry Centre
21 PUBLICATIONS **423** CITATIONS
SEE PROFILE

Christine Lamanna
Consultative Group on International Agricultural Research
79 PUBLICATIONS **4,050** CITATIONS
SEE PROFILE

Perspective

Outlook on AGRICULTURE

Outlook on Agriculture
1–11

DOI: 10.1177/00307270231196309
journals.sagepub.com/home/oag
Sage

Measuring agroecology and its performance: An overview and critical discussion of existing tools and approaches

Matthias S Geck[1], Mary Crossland[1] and Christine Lamanna[1]

Abstract

Agricultural and food systems (AFSs) are inherently multifunctional, representing a major driver for global crises but at the same time representing a huge potential for addressing multiple challenges simultaneously and contributing systemically to the achievement of sustainable development goals. Current performance metrics for AFS often fail to take this multifunctionality into account, focusing disproportionately on productivity and profitability, thereby excluding "externalities," that is, key environmental and social values created by AFS. Agroecology is increasingly being recognized as a promising approach for AFS sustainability, due to its holistic and transformative nature. This growing interest in and commitment to agroecology by diverse actors implies a need for harmonized approaches to determine when a practice, project, investment, or policy can be considered agroecological, as well as approaches that ensure the multiple economic, environmental, and social values created by AFS are appropriately captured, hence creating a level playing field for comparing agroecology to alternatives. In this contribution to the special issue on agroecology, we present an overview of existing tools and frameworks for defining and measuring agroecology and its performance and critically discuss their limitations. We identify several deficiencies, including a shortage of approaches that allow for measuring agroecology and its performance on landscape and food system scale, and the use of standardized indicators for measuring agroecology integration, despite its context-specificity. These insights highlight the need for assessments focused on these overlooked scales and research on how best to reconcile the need for globally comparable approaches with assessing agroecology in a locally relevant manner. Lastly, we outline ongoing initiatives on behalf of the Agroecology Transformative Partnership that aim to overcome these shortcomings and offer a promising avenue for working toward harmonization of approaches. All readers are invited to contribute to these collaborative efforts in line with the agroecology principle of participation and co-creation of knowledge.

Keywords

Agroecology, assessment frameworks, sustainable agriculture, food systems, transformation

Introduction

The concept of agroecology has evolved considerably over the last century. When the term was coined in the 1920s, it referred mainly to ecological research on agricultural plots or fields. Since the 1960s, through close interaction with agroecology as a way of farming and a growing peasant and political movement, the scope of agroecology has widened to encompass the first agroecosystems, as widely popularized by Gliessman and Altieri in the 1980s (e.g. Altieri, 1989; Gliessman, 1990), and subsequently agrifood systems in their full complexity (Silici, 2014; Wezel and Soldat, 2009; Wezel et al., 2009).

On the United Nations level, the highly systemic nature of agroecology has been recognized mainly through two seminal publications: (a) The Food and Agricultural Organization (FAO) defines agroecology based on 10 elements as

> An integrated approach that simultaneously applies ecological and social concepts and principles to the design and management of food and agricultural systems. It seeks to optimize the interactions between plants, animals, humans and the environment while taking into consideration the social aspects that need to be addressed for a sustainable and fair food system. (FAO, 2018, p. 1)

and (b) The Committee on World Food Security (CFS) in its high-level panel of experts (HLPE) Report (HLPE, 2019) which outlined 13 consolidated principles of agroecology and proposed the following definition in the context of food security and nutrition:

> Agroecological approaches favour the use of natural processes, limit the use of purchased inputs, promote closed cycles with minimal negative externalities and stress the importance of

[1] CIFOR-ICRAF, World Agroforestry (ICRAF), UN Avenue, Nairobi, Kenya

Corresponding author:
Mary Crossland, Livelihood Systems Associate Scientist, CIFOR-ICRAF, Nairobi, Kenya.
Email: m.crossland@cifor-icraf.org

> local knowledge and participatory processes that develop knowledge and practice through experience, as well as more conventional scientific methods, and address social inequalities. Agroecological approaches recognize that agrifood systems are coupled social–ecological systems from food production to consumption and involve science, practice, and a social movement, as well as their holistic integration, to address FSN. (HLPE 2019, p. 39)

Wezel et al. (2020) found the 13 consolidated principles "to be well aligned and complementary to the 10 elements of agroecology developed by FAO," while articulating certain crucial aspects more clearly. It is this specific recognition of the importance of simultaneously addressing agronomic, ecological, cultural, socio-economic, and political aspects of food systems that makes agroecology unique and distinguishes it from other approaches to sustainable agriculture such as climate-smart agriculture, conservation agriculture, nature-based solutions, organic agriculture, sustainable intensification, and regenerative agriculture (HLPE, 2019; IDS and IPES-Food, 2022; Pimbert, 2015; Wynberg et al., 2023). Yet, critics of agroecology point out that this complexity is challenging for many actors, and particularly the focus of agroecology on reducing dependence on external inputs is often viewed as problematic (Amede et al., 2023).

Agriculture is inherently multifunctional, providing not only income, food, and tradable commodities but also a vast array of non-monetary private and public goods and ecosystem services often referred to as externalities (Van Huylenbroeck et al., 2007). Given the intersections of agriculture with numerous economic, environmental, social, and political aspects and institutions, the need for a food systems perspective rather than reductionist approaches is increasingly being recognized (Alarcon et al., 2021; Stefanovic et al., 2020). Agrifood systems are central to the achievement of many of the sustainable development goals (SDGs) and are a major driver of global crises, while at the same time being adversely affected by the most eminent of them, including climate change, biodiversity loss, and land degradation. In light of multiple, complex, and interrelated food system challenges, the urgent need for fundamental food system transformations has become widely accepted in recent years (Ruben et al., 2021; Webb et al., 2020). Agroecology is arguably the only concept that is globally defined as being a holistic transformative approach to food systems, and there is mounting evidence of its potential to address several food systems challenges simultaneously (Bezner Kerr et al., 2023; HLPE, 2019; Mottet et al., 2020). In view of the above, an increasing number of actors—from multilateral organizations and international finance institutes to national governments, development agencies, and research and civil society organizations to farmer associations and private sector entities—embrace agroecological elements and principles and commit to supporting agroecological food system transformations. This is particularly well exemplified by the establishment and broad membership of the Coalition for the Transformation of Food Systems through Agroecology (Agroecology Coalition, n.d.). The growing interest in and commitment to agroecology by diverse actors implies a need for harmonized approaches to determine when a practice, project, investment, business case, or policy can be considered agroecological. Approaches to measuring agroecology can also be a very effective way of breaking down the complexity of agroecology into more concrete and tangible indicators. At the same time, there is a growing interest among both supporters and skeptics of agroecology in the performance of agroecology vis-a-vis alternatives.

In this contribution, we provide an overview of common approaches, tools, and frameworks that exist for defining and measuring agroecology and its performance and critically discuss some of the gaps and limitations of these existing approaches. Based on our analysis, we make several recommendations for progressing the assessment of agroecology and its performance and invite all readers to contribute to ongoing initiatives on behalf of the Agroecology Transformative Partnership aimed at overcoming some of these challenges.

Measuring the degree of agroecological integration

Project and portfolio level as well as tracking funding and investments

In the absence of globally recognized definitions of and frameworks for agroecology, early approaches to measuring agroecology relied on largely qualitative analysis (Figure 1). For example, Pimbert and Moeller (2018) analyzed contributions to agroecology in UK agricultural development assistance, qualitatively assigning projects to one of four categories (promoting agroecology, partially promoting agroecology, potentially promoting agroecology, and not promoting agroecology). Another early approach relied on the five levels of food system change and integration of agroecology outlined by Gliessman (2015, 2016). DeLonge et al. (2016) analyzed public US funding for domestic agricultural research, using a total of 34 indicators or subcategories corresponding to Gliessman (2015) levels one to four.

When FAO (2018) published the 10 elements of agroecology and the CFS HLPE (2019) proposed the 13 principles of agroecology, this paved the way for more systematic approaches to measuring the degree of agroecological integration in funding and project portfolios (Figure 2). Biovision (n.d.a), inspired by DeLonge et al. (2016), developed the Agroecology Criteria Tool (ACT), which integrates Gliessman's (2015) five levels of food system change with FAO's (2018) elements of agroecology (adding "regulation and balance" as an 11th element). The tool provides a total of 62 criteria corresponding to the different elements of agroecology to assess the degree to which each of them has been integrated. The criteria of ACT are binary and can only be marked as absent or present. ACT has mainly been designed to assess projects and funding portfolios but can also be applied to policies

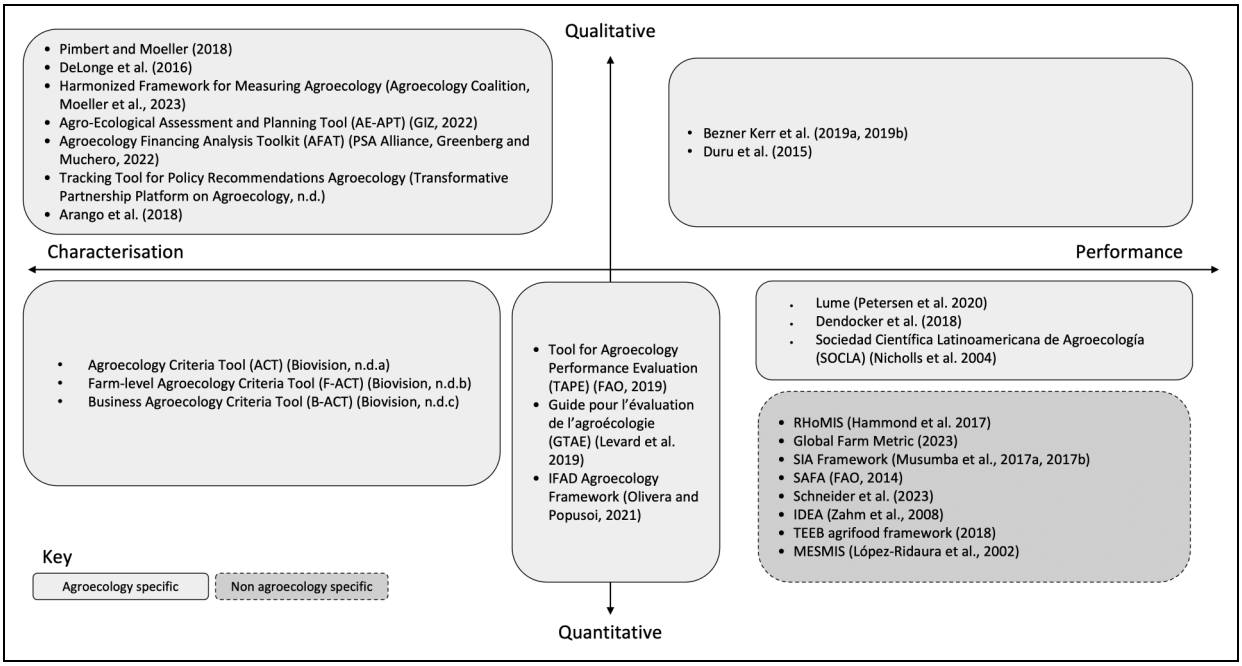

Figure 1. The approaches for measuring agroecology (i.e. characterization) and its performance reviewed in this contribution (including those listed in Tables 1 and 2) and mapped in relation to their quantitative or qualitative nature. The *x*-axis represents whether the approach primarily focuses on characterizing the degree of agroecology or measuring its performance. The *y*-axis represents whether the approach is primarily quantitative or qualitative in nature. *Note*: While we have attempted to place approaches in distinct quadrants, some may fall into more than one. Sourisseau (2014) and the unpublished method from la Via Campesina are excluded as do not specify metrics/methods.

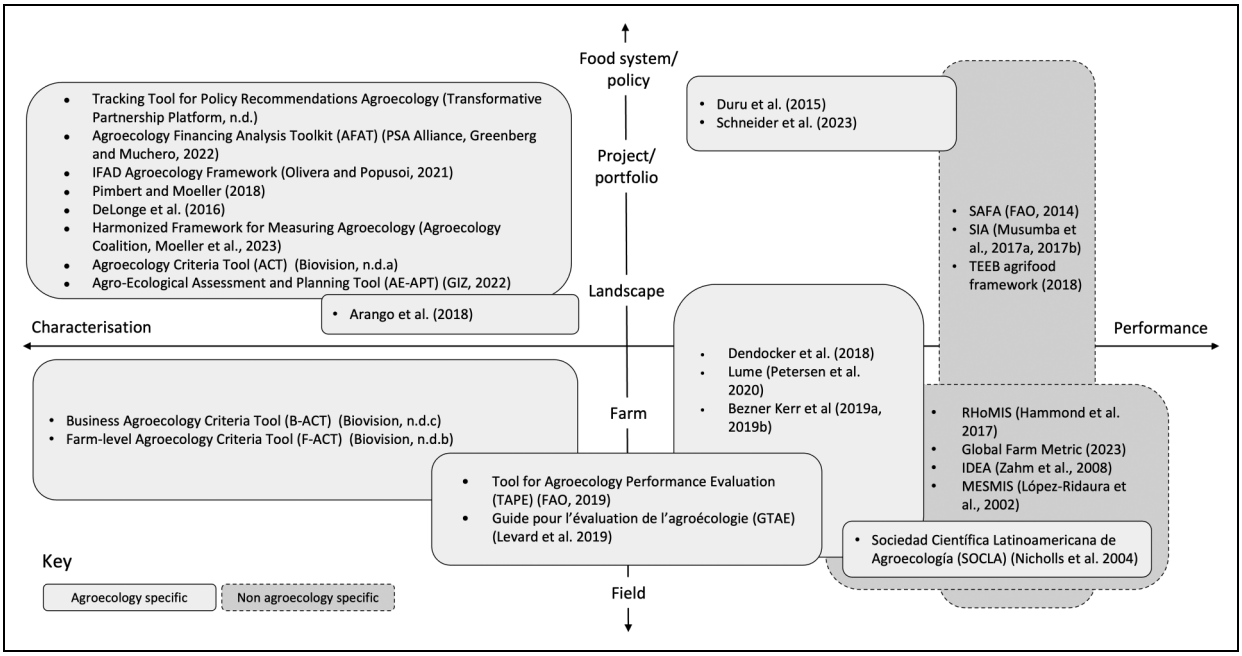

Figure 2. The approaches for measuring agroecology (i.e. characterization) and its performance reviewed in this contribution (including those listed in Tables 1 and 2) and mapped in relation to their level of focus. The *x*-axis represents whether the approach primarily focuses on characterizing the degree of agroecology or measuring its performance. The *y*-axis represents the level at which the approach primarily focuses. Here, the "farm" level includes households and businesses, the "landscape" level includes communities, and the "food system" includes policies and public/private sector investments. *Note*: While we have attempted to place approaches in distinct quadrants, some may fall into more than one. Sourisseau (2014) and the unpublished method from la Via Campesina are excluded as do not specify methods/metrics.

or strategies. The tool has been used by Biovision and IPES-Food (2020) to analyze to which degree investments in agricultural research for development integrate agroecology and by several donor organizations to measure how much of their funding portfolios contribute to agroecology. Further, several civil society and research organizations have analyzed additional project portfolios applying ACT or using a methodological approach inspired by ACT (e.g. Achterberg and Quiroz, 2021; Action Contre la Faim et al., 2020; DCA Alliance, 2020; Moeller, 2020; Vermeylen and De Schutter, 2020).

The German Agency for International Cooperation (GIZ), adapted ACT specifically to the Indian context with the objective of allowing decision-makers to assess the degree of agroecological integration in policies, programs, and projects (GIZ, 2022). While most of the general structure and criteria of ACT have been maintained, the GIZ (2022) agroecological assessment and planning tool (AE-APT) relies on the 13 principles of agroecology (HLPE, 2019; Wezel et al., 2020) rather than FAO's (2018) 10 elements. An additional major adaptation of ACT by GIZ (2022) is that a scaled score (from one to three or from one to five) is given per criterion, representing a major progression from Biovision's (n.d.a) binary nature. This results in a score per agroecology principle, facilitating the design, planning, and evaluation of projects, programs, and policies. Inspired by the application of ACT to its agriculture and food security portfolio, SDC, the Swiss Agency for Development and Cooperation (2020), developed its own tool for assessing how their projects contribute to agroecology, the "Agroecology Marker" is based on the 13 principles of agroecology (HLPE, 2019) and following the logic of the Organisation for Economic Co-operation and Development markers used for common reporting. To assess to which degree agroecology is integrated into the in-country portfolio of the International Fund for Agricultural Development (IFAD), Olivera and Popusoi (2021) developed IFAD's Agroecology Framework and applied it to 207 IFAD-supported projects. The IFAD Agroecology Framework is inspired by FAO's 10 elements but focuses on three core elements (efficiency, recycling, and diversity). If a project integrates these three elements at the farm or landscape level, it is considered agroecology-based (Olivera and Popusoi, 2021). At the core of the IFAD framework are 33 agroecology activity groups across farm, landscape/community, market, and policy levels. The presence or absence of the agroecology activity groups determines whether a project is classified as agroecological, partially agroecological, or non-agroecological.

Given the increasing interest in tracking finance for agroecology and the variety of different approaches and tools used (Table 1), a multi-stakeholder consortium developed a harmonized framework for tracking agroecology investments under the umbrella of the Agroecology Coalition and building upon the previous work carried out by a number of organizations, most notable Coventry University, CIDSE, Biovision, FAO, IFAD, and SDC. The proposed harmonized framework (Moeller et al., forthcoming) relies on the 13 consolidated agroecology principles (HLPE, 2019; Wezel et al., 2020) as a conceptual framework. For each principle, a score along a spectrum from zero to two is assigned in a qualitative manner based on normative statements and examples. An important component of the framework is the introduction of red lines, which when crossed imply that a project cannot be considered agroecological. Inspired by this collaborative work and

Table 1. Overview of 11 tools and frameworks for assessing the degree of agroecological integration.

Tool	Publisher (year of publication)	Framework used	Focus of application
ACT	Biovision (n.d.a)	10 elements (FAO), adapted	Projects and portfolio
AE-APT	GIZ (2022)	13 principles (HLPE)	Policies, programs, and project
Agroecology framework	IFAD, Olivera and Popusoi (2021)	10 elements (FAO), adapted	Projects and portfolio
Agroecology marker	Swiss Agency for Development and Cooperation (2020)	13 principles (HLPE)	Projects and portfolio
AFAT	PSA Alliance, Greenberg and Muchero (2022)	13 principles (HLPE)	Public sector investments
Harmonized framework for measuring agroecology	Agroecology coalition, Moeller et al. (forthcoming)	13 principles (HLPE)	Projects and portfolio
TAPE	FAO (2019)	10 elements (FAO)	Farm and household
F-ACT	Biovision (n.d.b)	13 principles (HLPE)	Farm and household
Guide pour l'évaluation de l'agroécologie	*Groupe de Travail sur les Transitions Agroecologiques*, Levard (2023)	6 criteria corresponding to 6 essential agroecology principles	Farm and household
B-ACT	Biovision (n.d.c)	13 principles (HLPE)	Business
Tracking tool for policy recommendations	Agroecology TPP (under development)	CFS policy recommendations on agroecology	Policy

ACT: agroecology criteria tool; AE-APT: agroecological assessment and planning tool; AFAT: agroecology financing analysis toolkit; TAPE: tool for agroecology performance evaluation; F-ACT: farm-level agroecology criteria tool; B-ACT: business agroecology criteria tool; IFAD: International Fund for Agricultural Development; FAO: Food and Agriculture Organization; TPP: transformative partnership platform; HLPE: high-level panel of experts; CFS: Committee on World Food Security.

largely using the same methodology, Greenberg and Muchero (2022) on behalf of the Partnership for Social Accountability Alliance developed the Agroecology Financing Analysis Toolkit (AFAT), with a specific focus on public sector spending in Africa.

Farm and household level

Apart from the project and portfolio levels, assessing agroecological integration at farm and household scales has received considerable attention (Figure 2). FAO (2019) produced the Tool for Agroecology Performance Evaluation (TAPE) through a highly participatory process (Mottet et al., 2020). The TAPE process consists of four steps, with step one being the characterization of agroecological transitions (CAET). CAET consists of 36 indices across the 10 elements of agroecology and for each, a score of zero to four is given based on predefined examples. The majority of data for CAET is collected at the household level but indices for the elements of co-creation and sharing of knowledge, circular, and solidarity economy, and responsible governance require interviews or focus group discussions at a community or territorial level. At the time of writing, TAPE had been applied on over 5000 farms in 40 countries, with a strong focus on sub-Saharan Africa (Mottet et al., 2023).

Inspired by FAO's CAET but relying on the 13 principles of agroecology (HLPE, 2019; Wezel et al., 2020) as well as 12 on- and off-farm components as a conceptual framework, Biovision (n.d.b) developed a farm-level version of the ACT (F-ACT). While the focus of F-ACT is on farm management, there are also a series of questions on aspects of society, markets, and policies where farmers potentially have agency. The questions in F-ACT are grouped according to which of the agroecology principles are addressed and which farm (soil, water, crops, livestock, trees, pest and disease, energy, household, and workers) or food system (community, value chain, and policy) component they relate to. For each question, there are predetermined answer options resulting in a score from zero to three. F-ACT is designed for participatory on-farm assessment through a highly reflective process, aimed at inspiring farmers and other food system actors to integrate contextually relevant agroecological practices and principles (Biovision, n.d.b).

Levard (2023) on behalf of the *Groupe de Travail sur les Transitions Agroecologiques* (GTAE) proposes a flexible method to calculate a farm-level agroecology score. While related to FAO's (2018) 10 elements and HLPE's (2019) 13 principles, the conceptual framework of the GTAE methodology does not directly rely on either of the two but rather allows for giving a qualitative score from zero to three for each of 19 sub-criteria, which are grouped in six criteria GTAE considers to correspond to essential agroecology principles. There are five criteria directly related to on-farm activities: crop and breed diversity, synergies, recycling, system autonomy, and soil health. The sixth criterion relates to the farm's contribution to an agroecological transition on the territory level, hence expanding from the farm to the landscape and food system level. The sum of the scores for each of the 19 sub-criteria allows for assigning an overall agroecology score (*agroécoloscore*) from A (strongly agroecological) to F (non-agroecological).

While FAO (2019), Biovision (n.d.b), and Levard (2023) do contain certain elements that go beyond the farm and incorporate some aspects of agroecology on the community, landscape, or food system level, the focus of all three tools is on the farm level. Given that agroecology has a strong food system focus, a tool or framework for specifically assessing the integration of agroecology principles and elements on the landscape or food system would provide immense added value. At the moment, we are not aware of the existence of such a tool. Further, most of the described tools use standardized indicators to assess the degree of agroecological integration, whereas agroecology emphasizes context-specificity. How to balance the need for globally comparable approaches with assessing agroecology in a locally relevant manner is a research question that merits more attention.

Business and private sector level

While a tool for assessing the integration of agroecology principles at the food system scale remains unavailable, what does exist is a dedicated tool for assessing the degree to which a private sector enterprise's activities and business model are aligned with HLPE's (2019) 13 principles of agroecology. Biovision (n.d.c) developed this tool in collaboration with partners to allow entrepreneurs not only to assess their own company but also to facilitate the decision-making of investors interested in investing in agroecological transitions. The Business ACT (B-ACT) provides an overall agroecology score as well as a breakdown for each of the 13 principles. It further provides specific suggestions on how to improve a low score in selected principles and an indication of the alignment of the assessed enterprise with specific SDGs. Biovision (n.d.c) is testing the tool with a variety of partners and target groups and based on the experiences and feedback the tool will be further refined.

Policy level

Policies mark an important area for assessing the integration of agroecology. While several of the tools or frameworks described above can and have been employed for assessing specific policies, none of them are specifically designed for that purpose. However, the African Center for Biodiversity (Greenberg, 2023) used the 13 agroecology principles (HLPE, 2019) to assess the degree of agroecological integration in 22 key policies across sectors in South Africa. This cross-sectorial approach is crucial, as the HLPE (2019) strongly emphasized the importance of policy coherence across sectors. The HLPE (2019) report on agroecology was followed by policy recommendations on agroecology endorsed by the CFS (CFS, 2021). To assess the degree of commitment to and implementation of these policy recommendations, the Transformative Partnership Platform (TPP) on Agroecological Approaches to Building Resilience of Livelihoods and Landscapes (Agroecology TPP, n.d.) and the Agroecology Coalition

have developed a tracking tool, which is currently being piloted and will be continuously refined based on the experiences and feedback received from a diversity of stakeholders.[1] The tool proposes 23 priority action areas across the five policy recommendations and associates each of the action areas with targets, indicators, and responsibilities to facilitate a goal-oriented and inclusive science-policy dialogue.

It is worth noting that in recommendation 1a) the CFS (2021, p. 5) calls upon all relevant actors to

> Undertake comprehensive and inclusive assessments of the sustainability of their agriculture and food systems (see Recommendation 2), paying due attention to all positive and negative environmental, economic, social externalities, trade-offs, and synergies, as the first step to developing context-specific transition pathways, in a coherent manner, as appropriate and in accordance with and dependent on national context and capacities.

As the (non-comprehensive) review above shows, there is a broad set of tools and frameworks available for measuring the degree of agroecological integration. The next section deals with the question of how the performance of agroecology can be adequately measured.

Measuring the performance of agroecology

Of the tools and frameworks described in the previous section, only FAO (2019), Levard (2023), and the IFAD Agroecology Framework directly combine measuring the degree of agroecological integration with a performance assessment (Figure 1). The value of combining these two aspects in a single framework is well-illustrated in the IFAD stock-take report on agroecology (Olivera and Popusoi, 2021). By first assessing, which of the IFAD-supported projects can be considered agroecology-based and subsequently comparing the contribution of different projects to IFAD's four mainstreaming priorities (gender, climate change, nutrition, and youth), Olivera and Popusoi (2021) are able to conclude that fully and partially agroecological projects address these priorities significantly more than non-agroecological projects.

Whereas step one of FAO (2019) TAPE assesses the degree to which the 10 elements of agroecology have been integrated on a household level, step two assesses core criteria of performance considered relevant for achieving the SDGs. The first step in developing the TAPE tool was a review of existing sustainability frameworks (included in Figures 1 and 2 and detailed in Table 2), which inspired some of the indicators for the core criteria as well as the overall structure and process of TAPE.

Table 2. The 12 assessment frameworks were reviewed during the development of TAPE.

Reference	Description
López-Ridaura et al. (2002)	MESMIS, a highly participatory and flexible framework for sustainability assessments of small farmer natural resource management systems, guides indicator selection rather than prescribing specific indicators.
Levard et al. (2019)	The *Mémento pour l'évaluation de l'agroécologie* of the French GTAE proposes a very comprehensive approach to evaluating the effects of agroecology on different sustainability dimensions.
Nicholls et al. (2004)	The agroecological method for participatory soil and crop health assessment was developed by the SOCLA.
Musumba et al. (2017a, 2017b)	The sustainable intensification assessment framework provides researchers with indicators to assess the performance of agricultural innovations in five sustainability domains (productivity, economic, environment, human condition, and social).
Petersen et al. (2020)	Lume: A method for the economic-ecological analysis of agroecosystems, a highly participatory approach for analyzing the interaction of different economic and ecological aspects relevant to agroecological transitions
La Via Campesina	An unpublished and unspecific method to assess the impacts of ZBNF in India was used by La Via Campesina.
TEEB (2018)	The TEEB for Agriculture and Food framework which is highly systemic and inspired by true cost accounting yet does not provide specific methods or indicators for assessments.
Sourisseau (2014)	The sustainable rural livelihood approach as discussed by Sourisseau (2014)
Bezner Kerr et al. (2019a, 2019b)	A qualitative approach for assessing the performance of agroecology in the context of East Africa
FAO (2014)	SAFA sustainability assessment of food and agriculture systems, a globally applicable set of 118 indicators designed to assess private enterprises (including farms) in four dimensions (environment, social, economy, and governance)
Hammond et al. (2017)	RHoMIS, a standardized household survey, which collects data on over 40 indicators across sustainability domains, focusing on production, market access, food security and nutrition, poverty alleviation and climate change mitigation.
Zahm et al. (2008)	The IDEA method for assessing farm sustainability which consists of 41 indicators across three dimensions or "scales" (agroecological, socio-territorial, and economic) and is designed for self-assessment by both farmers and policymakers

MESMIS: marco para la evaluación de sistemas de manejo de recursos naturales incorporando indicadores de sostenibilidad; TAPE: tool for agroecology performance evaluation; GTAE: Groupe de Travail sur les Transitions Agroecologiques; SOCLA: Sociedad Científica Latinoamericana de Agroecología; ZBNF: zero budget natural farming; RHoMIS: rural household multi-indicator survey.

Based on this review, a long list of over 60 performance indicators was developed, which was subsequently reduced to 10 core performance criteria—clustered in the five dimensions: governance, economy, health and nutrition, society and culture, and environment—through a participatory short-listing process (FAO, 2019). Each of the core criteria is aligned with relevant SDGs and specific SDG indicators. For each core criterion, data for a variable number of indicators are collected at the household level through a survey. Each indicator is rated with a traffic light, showing whether the status assessed in this domain of performance is desirable, acceptable, or unsustainable. In addition to the core criteria, FAO (2019) proposes a non-exhaustive list of advanced criteria in different sustainability dimensions. Recently, organizations applying TAPE have added to the menu of advanced indicators in specific performance areas or for a specific context. For instance, Association pour la Recherche et la Formation en Agroecologie (ARFA) developed a TAPE version for pastoralist systems in West Africa (Hebie, 2023), the Indigenous Partnership for Agrobiodiversity and Food Sovereignty adapted TAPE for indigenous peoples' food systems (Roy and Milbank, 2023) and Agroscope developed an advanced biodiversity indicator for TAPE (Merbold et al., 2023).

Mottet et al. (2020, p. 3) state "that there is no one-size-fits-all solution" to sustainability assessments, yet TAPE aims at creating globally harmonized and comparable datasets on the performance of agroecology, implying considerable methodological rigidity—that is, standardized protocols for data collection. Given the context-specificity of agroecology and the importance of co-creation in agroecological research, enhanced flexibility and emphasis on contextualization have been recommended to increase the value of the tool for local and regional actors (Namirembe et al., 2022). The CGIAR Initiative on Agroecology is currently developing an agroecological assessment tool that aims to strike the balance between global comparability and local contextual relevance (Wickramaratne et al., 2022). Once refined after piloting and testing with a broad range of local food system actors in the initiative's Agroecological Living Landscapes, the tool will be discussed with the global agroecology community and further refined before publication.

Levard et al. (2019) and Levard (2023) on behalf of the GTAE also provide approaches for specifically assessing the effects and performance of agroecology through detailed guidelines and evaluations sheets for a series of criteria relating to the agronomic, socio-economic, and environmental performance of agroecology. The GTAE framework is arguably the most comprehensive yet highly flexible approach to assessing agroecological performance but is currently only available in French. The approach proposed by Levard (2023) allows for combining performance results with a farm-level agroecology score and hence enables performance evaluation along a gradient of agroecological integration.

Additional approaches that may prove useful for different actors interested in measuring the performance of agroecology include those reviewed by Darmaun et al. (2023) and those compiled by GIZ (2023) in a methodological guide to assessing the socio-economic and environmental performance of agroecological practices (the latter, being a resource of immense value for anyone aiming to assess the performance of agroecology). Of the 14 assessment frameworks reviewed by Darmaun et al. (2023), five were considered specific to agroecology (and are included in Table 1 and Figures 1 and 2). In addition to those reviewed by TAPE and Levard et al. (2019), these are as follows:

1. The self-diagnosis of agroecological practices in a family farming context handbook by Arango et al. (2018), enables farmers to identify practices that are likely to contribute to 13 selected objectives in the environmental, socio-economic, and political/institutional dimensions.
2. Dendocker et al.'s (2018) four-step assessment framework for ecosystem services to guide agroecological transitions.
3. Duru et al.'s (2015) framework to design local agroecological transitions, which contains analytical elements but does not focus on performance assessment.

The evaluation criteria used by Darmaun et al. (2023, p. 1) in their review may also provide inspiration to those choosing which existing tools and frameworks to use:

> Key requirements for assessing agroecological transitions: 1) be adaptable to local conditions, 2) consider social interactions among stakeholders involved in the transitions, 3) clarify the concept of agroecology, 4) consider the temporal dynamics of the transitions to better understand barriers and levers in their development and 5) use a participatory bottom-up approach.

The methodological guide published by GIZ (2023) also provides useful guidance on how to select the appropriate methodology for assessing the effects of agroecology in a development context.

In addition to measuring the performance of agroecology, there is growing interest from both supporters and skeptics of agroecology in comparing the performance of agroecology vis-a-vis alternatives. To assess whether agroecology performs better than alternatives when performance is viewed holistically, avoiding an agroecology bias in the tool and indicator selection and reliance on well-established approaches is of crucial importance. Many of the approaches mentioned above may therefore be inadequate for this objective due to their strong agroecology bias. Instead, several other tools and frameworks we reviewed for assessing the performance of an agricultural and food system (AFS) do not specifically focus on agroecology (Figure 1) and could be considered suitable for comparing agroecology against alternatives, since they incorporate various dimensions of performance and sustainability and thereby do justice to the multifunctionality of agriculture.

Most of the frameworks we reviewed for measuring performance (both agroecology and non-agroecology-specific)

are designed for application on a farm or household level (Figure 2). Of the non-agroecology-specific approaches reviewed, the Global Farm Metric (2023) framework is particularly worth mentioning. The framework provides a series of indicators that allow for assessing the sustainability of a farming system in relation to 12 categories, recognizing that these categories are affected by farming practices as well as by a series of aspects beyond the farm. The framework's UK-centered development history may imply a bias toward farming systems in temperate climates and developed countries, but the framework can nonetheless be useful and inspirational for farm-level sustainability assessments in diverse ecological and socioeconomic contexts.

Agroecological transitions are often considered to take place on a landscape or territorial food system level, and the effects of several of the agroecology principles can hardly be evaluated on a farm or household scale alone. Yet, holistic performance assessment frameworks at a landscape or territory level are rare (Figure 2). Schneider et al. (2023) on behalf of the Food Systems Countdown to 2030 Initiative propose and apply a global indicator framework, structured in five domains: diets, nutrition, and health; environment, natural resources, and production; livelihoods, poverty, and equity; governance; and resilience and sustainability.

Frameworks such as Global Farm Metrics (2023) and the one proposed by Schneider et al. (2023) are incredibly useful for assessing the multifunctional performance of AFSs but do not necessarily align with some of the key values and principles of agroecology as a transdisciplinary science that emphasizes the importance of integrating different forms of knowledge and creating value for a diversity of stakeholders. For an agroecological performance assessment, it is pivotal to consider what is measured, through which means, by whom, and for whom.

The Agroecology TPP dedicates one of eight priority domains specifically to inclusive cross-scale metrics for agricultural systems. Central to the TPP's collaborative work in this domain is the European Union and IFAD-funded project Metrics for Agroecological Transitions. A key initial step in the Metrics project is a comprehensive and systematic review of holistic performance assessment frameworks across scales, which will soon be published. Stakeholder engagement for co-designing, testing, and validating cross-scale metrics is another key component of the project. All readers are kindly invited to engage with the Agroecology TPP and its partners in a co-creation process to fill some of the gaps in existing frameworks and address some of the shortcomings of existing tools to jointly develop approaches that allow all relevant stakeholders to measure what matters to them in a harmonized and yet context-specific manner.

Concluding remarks

As an increasing number of diverse stakeholders aim at supporting agroecological transitions, there is an urgent need for harmonized approaches to measuring agroecology and its performance. In this contribution, we provide an overview of some of the common approaches, tools, and frameworks that exist for assessing the degree of agroecological integration for different purposes and at different scales. While at the farm or household level as well as for assessing projects and portfolios, a variety of approaches are available, there is a shortage of frameworks that allow for measuring agroecology on a landscape or food system scale. Likewise, a considerable number of tools and frameworks allow for farm-level holistic performance assessment of different approaches to enhancing the sustainability of agriculture. Yet, performance assessment frameworks on the landscape or territorial food system level are rare, and key values and principles of agroecology as a transdisciplinary science are not always well integrated into performance assessment frameworks. Further, most of the tools for assessing the degree of agroecological integration used standardized indicators, despite agroecology emphasizing context-specificity. Based on these observations, we call for continued development of landscape and food systems scale assessment approaches and research on how best to balance the need for globally comparable approaches with assessing agroecology in a locally relevant manner.

Given the context-specific nature of AFS and the varying needs of actors, we do not believe there will ever be a perfect tool or framework for assessing agroecology that can meet every objective in all possible contexts. Nevertheless, multi-stakeholder collaborations, such as those described in this paper (e.g. Agroecology TPP, CGIAR Initiative on Agroecology, and Agroecology Coalition), present a promising approach for working toward harmonization. We also propose the development of practical guidance and design principles that could help actors interested in assessing AFS to select appropriate metrics and processes that meet their specific objectives. In the spirit of the agroecology principle of co-creation of knowledge, the Agroecology TPP invites all interested stakeholders to co-design frameworks and metrics for performance assessment that meet their needs and are well aligned with their values and priorities.

Declaration of conflicting interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The authors disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This work was supported by the International Fund for Agricultural Development (grant number 2000003774).

ORCID iD

Mary Crossland https://orcid.org/0000-0003-3887-2480

Note

1. All interested readers are invited to reach out to the Agroecology TPP secretariat (agroecology-tpp@cifor-icraf.org) and to engage in a co-design and co-implementation process.

References

Achterberg A and Quiroz D (2021) *Development Aid Funds for Agroecology: Support for Agroecology of Dutch ODA Spending*. Amsterdam: Profundo. Available at: https://www.bothends.org/uploaded_files/document/Dutch_ODA_Funding_for_Agroecology_Report.pdf

Action Contre la Faim, Terre Solidaire, and Oxfam France (2021) Une recette a la francaise: Une pincee d'agroecologie pour une louche d'agro-industrielle. *OXFAM France*. Available at: https://www.oxfamfrance.org/wp-content/uploads/2020/11/mediabreief_nov2020_EXEOKBD.pdf

Agroecology Coalition (n.d.) Available at: https://agroecology-coalition.org/agroecology-coalition (accessed 18 May 2023).

Alarcon P, Dominguez-Salas P, Fèvre EM, et al. (2021) The importance of a food systems approach to low and middle income countries and emerging economies: A review of theories and its relevance for disease control and malnutrition. *Frontiers in Sustainable Food Systems* 5: 642635.

Altieri MA (1989) Agroecology: A new research and development paradigm for world agriculture. *Agriculture, Ecosystems & Environment* 27(1–4): 37–46.

Amede T, Konde AA, Muhinda JJ, et al. (2023) Sustainable farming in practice: Building resilient and profitable smallholder agricultural systems in sub-Saharan Africa. *Sustainability* 15(7): 5731.

Arango D, Morel D and Mees M (2018) *Autodiagnostic des Pratiques Agroécologiques en Milieu Paysan. Guide Méthodologique*. Brussels: SOS Faim. Available at: https://www.sosfaim.be/wp-content/uploads/2020/10/SOS-20-guide-agro-UK-web.pdf

Bezner Kerr R, Costigo JC, Smith P, et al. (2023) Agroecology as a transformative approach to tackle climatic, food, and ecosystems crises. *Current Opinion in Environmental Sustainability* 62: 101275.

Bezner Kerr R, Kangmennaang J, Dakishoni L, et al. (2019a) Participatory agroecological research on climate change adaptation improves smallholder farmer household food security and dietary diversity in Malawi. *Agriculture, Ecosystems & Environment* 279: 109–121.

Bezner Kerr R, Young S, Young C, et al. (2019b) Farming for change: Developing a participatory curriculum on agroecology, nutrition, climate change and social equity in Malawi and Tanzania. *Agriculture and Human Values* 36(3): 549–566.

Biovision (n.d.a) Agroecology criteria tool. Available at: https://www.agroecology-pool.org/methodology (accessed 18 May 2023).

Biovision (n.d.b) Farm-level agroecology criteria tool. Available at: https://www.agroecology-pool.org/fact (accessed 18 May 2023).

Biovision (n.d.c) Business agroecology criteria tool. Available at: https://www.agroecology-pool.org/b-act (accessed 18 May 2023).

Biovision and IPES-Food (2020) *Money Flows: What is Holding Back Investment in Agroecological Research for Africa?* Biovision Foundation for Ecological Development and International Panel of Experts on Sustainable Food Systems. Zürich: Biovision and IPES-Food. Available at: https://www.agroecology-pool.org/moneyflowsreport/

CFS (2021) *Policy Recommendations on Agroecological and Other Innovative Approaches*. Rome: Committee on World Food Security. Available at: https://www.fao.org/fileadmin/templates/cfs/Docs2021/Documents/Policy_Recommendations_Agroecology_other_Innovations/2021_Agroecological_and_other_innovations_EN.pdf

Darmaun M, Chevallier T, Hossard L, et al. (2023) Multidimensional and multiscale assessment of agroecological transitions. A review. *International Journal of Agricultural Sustainability* 21(1): 2193028.

DCA Alliance (2020) *Sustainability Starts From the Ground: A Publication on the Potential of Agroecology Interventions and an Assessment of Agroecology Integration in Danish Development Aid*. Kopenhagen: ACT Alliance.

DeLonge MS, Miles A and Carlisle L (2016) Investing in the transition to sustainable agriculture. *Environmental Science & Policy* 55(1): 266–273.

Dendoncker N, Boeraeve F, Crouzat E, et al. (2018) How can integrated valuation of ecosystem services help understanding and steering agroecological transitions? *Ecology and Society* 23(1): 12. https://www.jstor.org/stable/26799041.

Duru M, Therond O and Fares M (2015) Designing agroecological transitions: A review. *Agronomy for Sustainable Development* 35: 1237–1257.

FAO (2014) *SAFA: Sustainability Assessment of Food and Agriculture Systems (Guidelines)*. Rome: Food and Agriculture Organization of the United Nations. Available at: https://www.fao.org/3/i3957e/i3957e.pdf

FAO (2018) *The 10 Elements of Agroecology: Guiding the Transition to Sustainable Food and Agricultural Systems*. Rome: Food and Agricultural Organization of the United Nations. Available at: https://www.fao.org/3/i9037en/i9037en.pdf

FAO (2019) *TAPE Tool for Agroecology Performance Evaluation 2019 – Process of development and guidelines for application. Test version*. Rome: Food and Agriculture Organization of the United Nations.

GIZ (2022) *User Manual for Agro-Ecological Assessment and Planning Tool (AE-APT)*. Delhi: Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmBH.

GIZ (2023) *Analyses of Socio-Economic and Environmental Effects of Agroecological Practices: A Methodological Guidance*. Bonn: Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmBH.

Gliessman S (2016) Transforming food systems with agroecology. *Agroecology and Sustainable Food Systems* 40(3): 187–189.

Gliessman SR (1990) Agroecology: researching the ecological basis for sustainable agriculture. In: Gliessman SR (eds) *Agroecology. Ecological Studies*, 78. New York: Springer.

Gliessman SR (2015) *Agroecology: The Ecology of Sustainable Food Systems*, 3rd ed. Boca Raton: CRC Press.

Global Farm Metric (2023) *The Global Farm Metric framework: Categories, sub-categories and indicators explained*. Available at: https://www.globalfarmmetric.org/wp-content/uploads/2023/05/GFM-1.1-lite-FINAL-RPK-09052023.pdf.

Greenberg S (2023) *An Assessment of Support for Agroecology in South Africa's Policy Landscape*. Johannesburg: The African Center for Biodiversity. Available at: https://acbio.org.za/wp-content/uploads/2023/05/Assessment-for-agroecology-in-South-Africa.pdf

Greenberg S and Muchero MT (2022) *Agroecology Financing Analysis Toolkit (AFAT) for the public sector in Africa*. Partnership for Social Accountability Alliance. Available at: https://psa.copsam.com/wp-content/uploads/2023/01/agroecology_financial_toolkit.pdf

Hammond J, Fraval S, van Etten J, et al. (2017) The rural household multi-indicator survey (RHoMIS) for rapid characterisation of households to inform climate smart agriculture interventions: Description and applications in East Africa and Central America. *Agricultural Systems* 151: 225–233.

Hebie S (2023) La version TAPE pour les pastoralistes au Burkina Faso. In: *TAPE Validation Workshop*, Rome, 2–3 May 2023. Unpublished.

HLPE (2019) Agroecological and other innovative approaches for sustainable agriculture and food systems that enhance food security and nutrition. A report by the High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security, Rome. Rome: High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security. Available at: http://www.fao.org/cfs/cfs-hlpe/en/.

IDS & IPES-Food (2022) *Agroecology, Regenerative Agriculture, and Nature-Based Solutions: Competing Framings of Food System Sustainability in Global Policy and Funding Spaces*. Brighton: Institute of Development Studies and International Panel of Experts on Sustainable Food Systems. Available at: https://www.ipes-food.org/_img/upload/files/SmokeAndMirrors_BackgroundStudy.pdf

Levard L (2023) *Guide Pour L'évaluation de L'agroécologie. Méthode Pour Apprécier ses Effets et les Conditions de son Développement*. Versailles: Éditions du Gret/Éditions Quæ.

Levard L, Bertrand M and Masse P (2019) *Mémento pour l'évaluation de l'agroécologie: Méthodes pour évaluer ses effets et les Conditions De Son Développement*. Paris: GTAE-AgroParisTech-CIRAD-IRD. Available at: https://horizon.documentation.ird.fr/exl-doc/pleins_textes/2021-06/010080342.pdf

López-Ridaura S, Masera O and Astier M (2002) Evaluating the sustainability of complex socio-environmental systems. The MESMIS framework. *Ecological Indicators* 2(1–2): 135–148.

Merbold L, Felder R, Baumgartner S, et al. (2023) An advanced biodiversity indicator for TAPE. In: *TAPE Validation Workshop*, Rome, 2–3 May 2023. Unpublished.

Moeller NI (2020) *Analysis of Funding Flows to Agroecology: The Case of European Union Monetary Flows to the United Nations' Rome-Based Agencies and the Case of the Green Climate Fund*. Brussels: CIDSE & CAWR. Available at: https://www.cidse.org/wp-content/uploads/2020/09/AEFinance-background-paper-final.pdf

Moeller NI, Geck M, Anderson CR, et al. (2023) Measuring agroecology: Introducing a methodological framework and a community of practice approach. *Elementa* (submitted manuscript No. ELEMENTA-D-23-00042R1).

Mottet A, Bicksler A, Lucantoni D, et al. (2020) Assessing transitions to sustainable agricultural and food systems: A tool for agroecology performance evaluation (TAPE). *Frontiers in Sustainable Food Systems* 4: 579154.

Mottet A, Cluset R, Lucantoni D, et al. (2023) Tool for agroecology performance evaluation (TAPE). In: *TAPE Validation Workshop*, Rome, 2–3 May 2023. Unpublished.

Musumba M, Grabowski P, Palm C, et al. (2017a) *Guide for the Sustainable Intensification Assessment Framework*. Washington: Feed the Future. Available at: https://www.k-state.edu/siil/documents/docs_siframework/Guide%20for%20SI%20Assessment%20Framework%20-%2010.24.17.pdf

Musumba M, Grabowski P, Palm C, et al. (2017b) *Sustainable Intensification Assessment Framework Methods Manual*. Washington: Feed the Future. Available at: https://www.k-state.edu/siil/documents/docs_siframework/Sustainable%20Intensification%20Assessment%20Methods%20Manual%20-%2010.24.17c.pdf

Namirembe S, Mhango W, Njoroge R, et al. (2022) Grounding a global tool—principles and practice for agroecological assessments inspired by TAPE. *Elementa: Science of the Anthropocene* 10(1): 00022.

Nicholls C, Altieri M, Dezanet A, et al. (2004) A rapid, farmer-friendly agroecological method to estimate soil quality and crop health in vineyard systems. *Biodynamics* 2004: 33–40.

Olivera R and Popusoi D (2021) *Stock-Take Report on Agroecology in IFAD's Operations: An Integrated Approach to Sustainable Food Systems*. Rome: International Fund for Agricultural Development (IFAD). Available at: https://www.ifad.org/documents/38714170/45258342/PMI+Agroecology+assessment.pdf/d39e37dd-8c35-c909-669d-906bb3ad716f?t=1649164401038

Petersen P, Marçal da Silveira L, Bianconi Fernandes G, et al. (2020) *Lume: A Method for the Economic-Ecological Analysis of Agroecosystems*. Coventry: Centre for Agroecology, Water and Resilience (CAWR), Coventry University. Available at: https://aspta.org.br/files/2015/05/Lume-a-method-for-the-economic-ecological-analysis-of-agroecosystems.pdf

Pimbert M (2015) Agroecology as an alternative vision to conventional development and climate-smart agriculture. *Development* 58: 286–298.

Pimbert MP and Moeller NI (2018) Absent agroecology aid: On UK agricultural development assistance since 2010. *Sustainability* 10(2): 05.

Roy BP and Milbank C (2023) TAPE: Tool for Agroecology Performance Evaluation adapted for indigenous peoples' food systems. In: *TAPE Validation Workshop*, Rome, 2–3 May 2023. Unpublished.

Ruben R, Cavatassi R, Lipper L, et al. (2021) Towards food systems transformation—five paradigm shifts for healthy, inclusive and sustainable food systems. *Food Security* 13(6): 1423–1430.

Schneider K, Fanzo J, Haddad L, et al. (2023) The state of food systems worldwide: Counting down to 2030. Preprint. DOI: 10.48550/arXiv.2303.13669.

Silici L (2014) Agroecology: What it is and what it has to offer. *IEED Issue Paper*. IIED, London. Available at: https://www.iied.org/sites/default/files/pdfs/migrate/14629IIED.pdf.

Sourisseau JM (2014) Système d'activités et "sustainable rural livelihood" (SRL). In: Michel E (eds) *Élevages et Territoires: Concepts, Méthodes, Outils*. Paris: INRA, pp. 109–120.

Stefanovic L, Freytag-Leyer B and Kahl J (2020) Food system outcomes: An overview and the contribution to food systems transformation. *Frontiers in Sustainable Food Systems* 4: 546167.

Swiss Agency for Development and Cooperation (2020) *Agroecology Marker*. Unpublished.

TEEB (2018) *TEEB for Agriculture and Food: Scientific and Economic Foundations*. Geneva: UN Environment. Available at: https://teebweb.org/wp-content/uploads/2018/11/Foundations_Report_Final_October.pdf

Transformative Partnership Platform on Agroecology (n.d.) Available at: https://glfx.globallandscapesforum.org/topics/21467/page/TPP-home (accessed 18 May 2023).

Van Huylenbroeck G, Vandermeulen V, Mettepenningen E, et al. (2007) Multifunctionality of agriculture: A review of definitions, evidence and instruments. *Living Reviews in Landscape Research* 1(3): 1–43.

Vermeylen M and De Schutter O (2020) *The share of agroecology in Belgian official development assistance: An opportunity missed*. CRIDHO Working Paper 2020:3. Available at: https://www.inter-reseaux.org/en/ressource/document-de-travail-the-share-of-agroecology-in-belgian-official-development-assistance-an-opportunity-missed/.

Webb P, Benton TG, Beddington J, et al. (2020) The urgency of food system transformation is now irrefutable. *Nature Food* 1(10): 584–585.

Wezel A, Bellon S, Doré T, et al. (2009) Agroecology as a science, a movement and a practice. A review. *Agronomy for Sustainable Development* 29(4): 503–515.

Wezel A, Herren BG, Kerr RB, et al. (2020) Agroecological principles and elements and their implications for transitioning to sustainable food systems. A review. *Agronomy for Sustainable Development* 40(6): 40.

Wezel A and Soldat V (2009) A quantitative and qualitative historical analysis of the scientific discipline of agroecology. *International Journal of Agricultural Sustainability* 7(1): 3–18.

Wickramaratne C, Jones S, Lamanna C, et al. (2022) The measure of agroecology: Developing an assessment framework to economic, environmental and social impacts of agriculture and food systems. Available at: https://www.cgiar.org/news-events/news/the-measure-of-agroecology (accessed 18 May 2023).

Wynberg R, Pimbert M, Moeller N, et al. (2023) Nature-based solutions and agroecology: Business as usual or an opportunity for transformative change? *Environment: Science and Policy for Sustainable Development* 65(1): 15–22.

Zahm F, Viaux P, Vilain L, et al. (2008) Assessing farm sustainability with the IDEA method—from the concept of agriculture sustainability to case studies on farms. *Sustainable Development* 16(4): 271–281.