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Agroecology for climate-resilient and nourishing food systems: A scoping study of priorities for research and development actions in Southeast Asia

A final report by World Vegetable Center

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Contents

Executive summary

Background and objectives: Given the rapid pace of development in Southeast Asia, there are great environmental and climate change concerns associated with the unsustainable intensification of agri-food systems. Agroecology offers a holistic pathway to achieving resilient, equitable and nourishing food systems by addressing the gap between food production, ecosystem sustainability and social equity. However, there are large knowledge gaps on which and how agroecological approaches can be adopted to achieve positive impacts in rapidly evolving contexts in Southeast Asia. Governments and stakeholders need guidance on how agroecology can be integrated into programs, policies and initiatives, contributing to the food system transformation. In this context, World Vegetable Center (WorldVeg) conducted a scoping study to identify research gaps and development priorities for agroecological transition to climate-resilient and nourishing food systems in Southeast Asia.

Methodology: A mixed-methods approach, combining a rapid review of peer-reviewed and grey literature and consultations of experts working on agroecology in Southeast Asia, was employed. In total, 406 publications were selected for the screening of title, abstract and keywords, and 60 publications were included in analysis. Over four hundred experts were identified through the literature review and snowball sampling and 47 were consulted through virtual interviews or written questionnaires. The literature review focused on selected common agroecological areas (sustainable soil management, integrated pest management and crop diversification and integrated farming systems) and assessed their impacts related to the High-Level Panel of Experts on Food Security and Nutrition's 13 principles of agroecology. The expert consultations had a broader scope capturing progress, successes, and research priorities centered around 13 agroecological principles and the status of transition across Southeast Asia.

General findings and impacts**:** In the rapid review, most included studies focused on integrated farming systems and crop diversification (*n*=46), with agroforestry (*n*=20) being the most often studied subject area. Indonesia and Vietnam featured the highest number of studies (27 and 19, respectively), followed by Thailand and Myanmar with ten and nine studies, respectively, seven studies in Laos, six in Cambodia and five in the Philippines. Staple food grains, particularly rice, were the most widely covered category of produced items in all agroecological studies. Fruits and then trees categories followed staple food grains. The review found that agroecological approaches have generally positive impacts associated with the 13 principles of agroecology. The most common positive effects of farm diversification and integration were increased household income and improved food security and nutrition. More specifically, several studies identified that crop diversification and integrated farming systems were associated with increased food security and dietary diversity in farming households. Positive impacts on ecosystem services, soils and biodiversity were also relatively commonly reported. Compared to the review by Hett et al. (2023) of agroecological initiatives in the Mekong region, we found less evidence of the effects of agroecological approaches on biodiversity, land and resource governance, likely due to the specific search strategy of our literature review.

Climate change**:** Agroecological approaches, such as regenerative practices, conservation measures and agroforestry, can contribute to climate change adaptation and mitigation, however, only nine articles included in our review examined this relationship. A few case studies demonstrated that integrated production systems (e.g., rice-fish, crop-livestock, mixed agroforestry) can contribute to ecosystem maintenance and resilience to climate change and natural disasters. Only one study looked at greenhouse gas (GHG) emissions, which indicates a large knowledge gap regarding the effects of agroecology on GHG emissions. According to consulted experts, one of the major sources of GHG emissions in Southeast Asia is agriculture and land-use change. Experts further identified that all Southeast Asian countries are highly vulnerable to the impacts of climate change. They mentioned a growing awareness of the environmental, health, and economic costs associated with climate-related disasters, which are concerns that drive interest in agroecological alternatives. Due to the frequent typhoons, the Philippines was identified as the most climate-vulnerable. But the country seems to lean more towards technological and conventional intensification of agriculture, probably due to frequent disasters and the need of farmers to maximize and fasten the production between the typhoons.

***Gender and inequality*:** Gender was only addressed in 11 studies in our review, but included literature suggests positive effects of women's participation in the development and dissemination of agroecological innovations. One study concluded that women's participation can help spread innovations to a wide audience through their social networks and that participation is more likely when initiatives are complementary or an extension of existing gender roles. Women's roles and decision-making in agriculture and resource management were shown to be relatively limited, with men playing a larger role in decisions. One larger study from Indonesia, Vietnam, and the Philippines found evidence of inequality in resource access that favored men. Both literature sources and experts suggested that the rights of Indigenous women and girls are a matter of great concern because they suffer disproportionately from social, economic and political marginalization and discrimination, but also because, if given the opportunity, they are often effective agents of change within their communities.

Adoption and barriers: There was limited information on the determinants of the adoption of agroecological practices, representing a future research need. A few important barriers that were identified in the literature were high initial costs of adopting agroecological practices, limited market access for small-scale farmers producing agroecological products, and the high price of third-party certification processes. Some experts mentioned unfavorable policies, lack of agroecological knowledge, time and risks associated with new practices and limited national budgets for R&D support. Considering the determinants of agroecological adoption, participatory approaches linking producers and consumers and building mutual trust can facilitate successful models and technology transfer in real contexts. Experts also highlighted the urgent need to develop the capacity of local universities and to co-create solutions with them.

Development solutions: Agroecological innovations such as food networks and sustainable value chains, including creating and strengthening bottom-up certification schemes (e.g. participatory guarantee systems) enabled smallholder farmers to participate and obtain certification of their products, based on active participation while building on trust, social networks and knowledge sharing. However, some experts remarked that such schemes work only in larger cities with growing demand and that they often depend on external funding. It is also important to promote agroecological principles in policy and through advocacy. This might include supporting alternative extension approaches like farmer field schools, which are recognized as a powerful extension instrument. Learning from the ALiSEA agroecological network, national foresight and vision to action workshops also appear as promising interventions for planning, stimulating and monitoring agroecology futures in individual countries.

Agroecological transition: The majority of experts conveyed that only limited or moderate progress has been made in agroecological transitions in Southeast Asia. Cambodia and Vietnam were often mentioned as the countries with the highest probability of achieving agroecological goals in the next two decades. In addition, experts mentioned that the presence of financial and technical support from the UN, development banks, bilateral donors and international NGOs and agricultural research institutions strongly accelerate the transition to agroecology and related policy changes.

Research gaps and priorities: Studies examining the effects of integrating multiple agroecological practices and principles are scarce, and more evidence is needed to inform effective program design. Sustainable soil management practices have a positive impact on the environment and the economy, but the cascading effect on livelihoods, food security or diets is yet to be evidenced. Further research should optimize integrated production systems to increase efficiency, resilience and circularity, while finding ways to reverse ongoing soil and water degradation in farms that have transitioned to monocropping systems. While adaptation of agriculture to a changing climate in this vulnerable region is crucial, future research should address a major knowledge gap in the greenhouse gas emissions and climate change mitigation potential of agroecology. Further efforts are needed to understand the impact of agroecological interventions on gender and social differences and inform best-practice guidelines to support inclusion and equity. A few experts mentioned a need to strengthen participatory guarantee schemes in different Southeast Asian countries and find ways to make the scheme financially independent. Overall, we found little evidence on several agroecology principles related to the agroecosystem level (synergies, animal health and recycling) and the food systems level (equity, connectivity and social values).

Despite the growing interest in territorial and landscape approaches, bottom-up processes, and living labs, we found a lack of evidence on the impact and cost-effectiveness of these approaches in the region. Moreover, the focus on food system transformation through advocacy and policy change is also still missing. Agroecological innovations are often studied in a research environment and at the local level, while cross-sectoral approaches, integration at scale and multi-stakeholder collaboration between research and practice are still largely missing. National and regional networks appear highly beneficial for knowledge exchange, advocacy, and to drive change, but their sustainability is often subject to funding and external support. Finally, further research should evaluate the economic, environmental and health impacts of the previous and future agroecology-related policies and programs.

1. Introduction

Climate change is the defining crisis of our time, and no corner of the globe is immune to its devastating consequences. Effects of climate change fall disproportionately on the poor and vulnerable populations due to a combination of adverse agro-climatic, socio-economic and technological conditions (Rosenzweig & Hillel, 2008). Smallholder farmers, who produce more than half of the total global food supply, are the most vulnerable because changes in temperature, rainfall and the frequency or intensity of extreme weather events directly affect their agricultural productivity, on which they rely heavily for food security, income and household well-being (Mbow et al., 2022).

The set of standardized technologies introduced into agricultural systems during the Green Revolution, in pursuit of solutions to end world hunger and food shortages, has failed to feed and nourish the world's poor, despite the increase in global per capita food supply, and has triggered several negative socioeconomic and environmental impacts (Palomo-Campesino et al., 2018; Amoak et al., 2022). In 2015, emissions from food systems —encompassing food production, transportation, processing and consumption, including food losses and waste— contributed to one-third of global emissions, with the largest contribution (71%) coming from agriculture and land-use changes (Crippa et al., 2021). The projected growth of the world's population from 8.2 billion in 2024 to 10.3 billion in the mid-2080s raises concerns about how agricultural systems must adapt to provide enough food to meet growing demand and support healthy diets for all, while maintaining ecosystem health and promoting social equity (UN-DESA, 2024). It is important that action is taken to make farming systems around the world more sustainable, resilient and equitable, to benefit especially those who derive their livelihoods and food security directly from agriculture (Amoak et al., 2022).

Nature-based solutions are solutions for environmental and societal challenges based on processes and functions of nature. These allow us to mitigate part of our carbon footprint while supporting the transition to sustainable and climate-resilient food systems (Keesstra et al., 2023). Agroecology has emerged in the political and scientific arenas as an alternative approach to address the gap between food production, ecosystem sustainability and social equity (Palomo-Campesino et al., 2018). It has been recognized as a potential pathway to climate-resilient food systems, given its transformative potential for climate change adaptation and mitigation (IPCC, 2022).

For instance, the diversification of staple-based cropping systems with legumes generates double wins of climate-resilient and nutrition-sensitive production systems. Legumes provide a plant-based source of high-quality food and therefore have a significant role in addressing global food and nutritional security, as well as contributing to ecosystem services (Kumar et al., 2022). While lessons learned from individual case studies are valuable and showcase the potential of agroecology, results are not always directly relevant to other contexts (Dumont et al., 2021). There are research gaps and limited evidence of which agroecological practices work in different contexts. This is particularly true for vegetables, other horticultural crops and legumes, as previous research on agroecology has focused mainly on the most important staple food grains in the region (rice and maize) and largely overlooked other agricultural commodities and diverse smallholder production systems.

Food systems in Southeast Asia mostly involve smallholder farms, with an estimated 100 million smallholder farmers in the region (Mikolajczyk et al., 2021). Given the rapid pace of development in Southeast Asia, there are great environmental and climate change concerns associated with the unsustainable intensification of agri-food systems. To support the agroecological transition in the region, agroecological approaches with validated positive impacts and a higher likelihood of adoption in a rapidly evolving Southeast Asia need to be identified. The scientific community, including technical experts, can use the evidence and guide governments and stakeholders on how agroecology can be integrated into programs, policies and initiatives contributing to the transition to sustainable and resilient food systems. In this context, WorldVeg conducted a scoping study with the main goal of identifying research gaps and

development priorities for agroecological transition to climate-resilient and nourishing food systems in Southeast Asia.

To achieve this goal, the study first reviewed the existing evidence from agroecological studies and initiatives to identify and assess integrated agroecological approaches that contribute to the transition to climate-resilient food systems in Southeast Asia. It focuses on agroecological systems and on the social and economic dimensions of food systems. By applying a rapid literature review method, we limited the scope to three selected areas of agroecological practices that have been commonly studied in the literature and that also align with WorldVeg's expertise: (1) sustainable soil management, (2) integrated pest management and (3) crop diversification and integrated farming systems, and assessed their impact on safe, healthy and sustainable diets, as well as related socio-economic and environmental effects. For this purpose, the 13 principles of agroecology by the High-Level Panel of Experts (HLPE) on Food Security and Nutrition are used as an analytical framework, considering whether any of the principles were included in the studies. Climate change and gender equity were cross-cutting themes throughout the study, given that climate change disproportionately affects the most vulnerable households and that gender influences the opportunity and motivation to adopt agroecological practices, and the benefits derived.

Second, we conducted consultations of experts on agroecology and related fields in Southeast Asia. The expert consultations had a broader scope capturing progress, successes, and research priorities centered around 13 agroecological principles and the status of transition across Southeast Asia. Over four hundred experts were contacted, and 47 were consulted mainly through an online interview or by filling out the questionnaire.

This scoping study report starts with the introduction and context of the topic, followed by the methodology section, where the literature review and expert consultation approaches are explained. Afterward, the results section starts with a general overview of the included studies and information, followed by describing the impacts of agroecological approaches at the agroecosystem and food system levels, over to linkages of agroecology with climate change, gender and social inequality, status of agroecological transition in Southeast Asia, and finally research priorities and recommendations. After the results, a brief section overviews the key agroecology stakeholders in the region, which is followed by the conclusion and references. The report also has six annexes where relevant details are provided.

2. Methodology

2.1 Conceptual framework

Agroecology emerges as a transdisciplinary approach that includes the ecological, socio-cultural, technological, economic and political dimensions of food systems (Leippert et al., 2020). Although there are different definitions and understandings of agroecology, there is a notable convergence of terms and definitions resulting in the formation of principles, elements, and levels of transition brought forward recently with numerous representative examples of the adoption of agroecological principles across the globe (Atta-Krah et al. 2021; Wezel et al. 2020).

Agroecological transition can be characterized by five levels of transitions proposed by Gliessman (2016). The first three levels describe the steps farmers can take on their farms to convert from industrial or conventional agroecosystems. Two additional levels go beyond the farm to the broader food system and the societies in which they are embedded. All five levels, taken together, can serve as a road map that outlines, almost stepwise, a process for transforming the entire global food system (Gliessman, 2016). Since agroecology is based on bottom-up and territorial processes, common principles were articulated to characterize its inherent properties and to ensure a common understanding within the framework of the ten elements of agroecology developed by FAO and the consolidated list of 13 principles developed by HLPE (2019). Both represent a comprehensive attempt to crystallize the definition and application of

agroecology through a series of principles. They are aligned and complementary, but the 13 principles articulate the requirements of soil and animal health more explicitly and distinguish between biodiversity and economic diversification (Wezel et al., 2020). They encompass different scales which can be linked to Gliessman's five levels of transition towards sustainable food systems (Figure 1).

The present study followed the 13 principles and five levels of agroecological transition. The literature review focused largely on the outcomes of selected agroecological approaches related to the 13 principles, while the expert consultations focused more on actions, solutions and research gaps across the 13 principles.

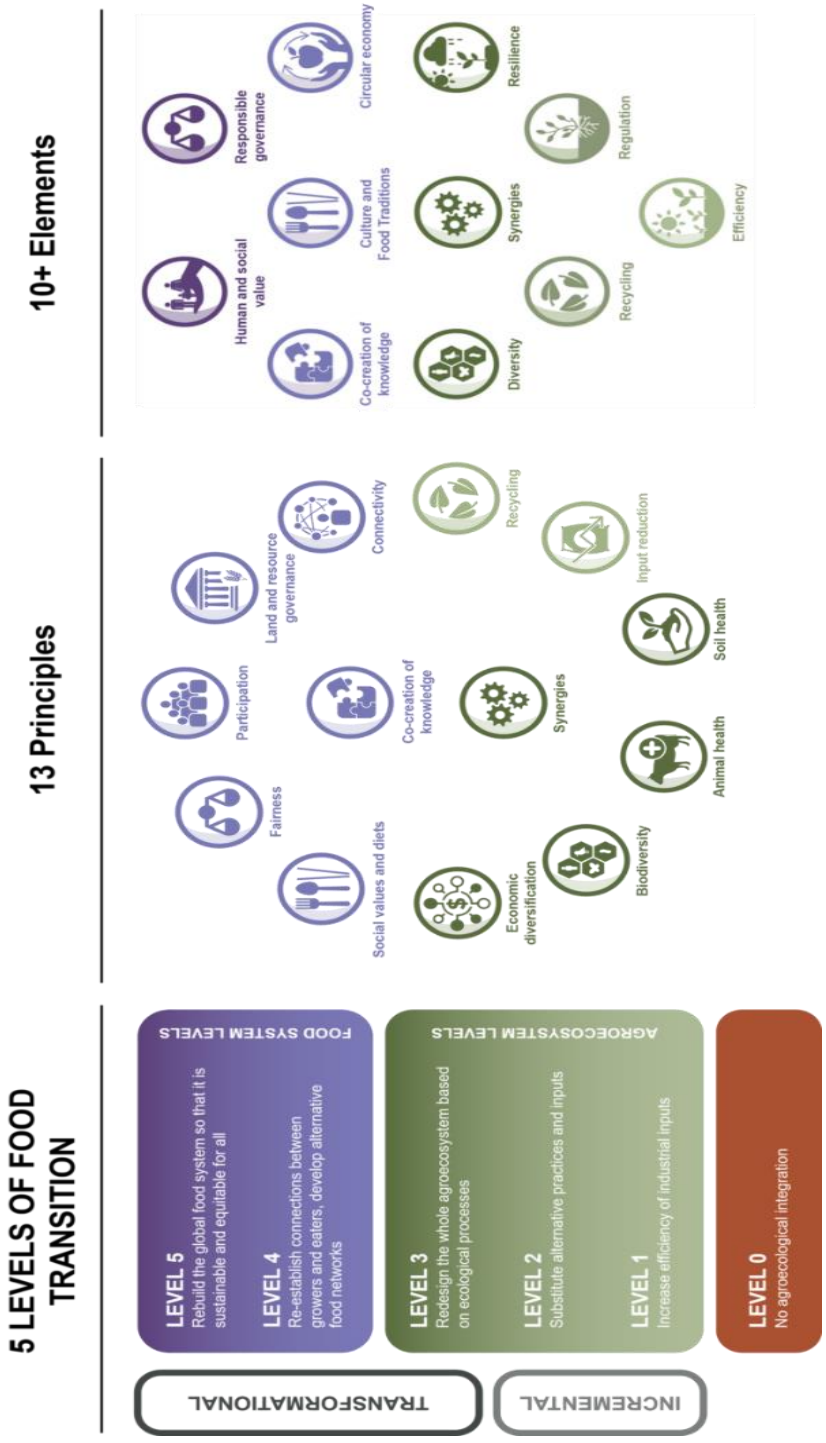

Figure 1 Five levels of agroecological transition as they relate to the 13 principles and the 10+ elements.
Source: Biovision 2019, inspired by Gliessman (2016), and HLPE (2019).

2.2 Literature review

To compile and synthesize evidence from peer-reviewed articles and other publications focusing on agroecology in Southeast Asia, a rapid literature review methodology was applied. To date, there is no formal definition, nor a set of standardized or commonly agreed methods for conducting rapid reviews. The most widely used guidelines are the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) and the Cochrane Rapid Reviews Methods Group (RRMG). To conduct the rapid literature review, we adapted the PRISMA protocol with four phases (Figure 2) and followed the steps and recommendations from Tricco et al. (2017); King et al. (2022); and Garritty et al. (2020).

This review considered scientific literature published in the electronic database Elsevier Scopus, as well as grey literature manually searched in the online repositories of several well-established institutions written in the English language (A total of 12 online repositories/websites were consulted: CGIAR repository called CGSpace; FAO Knowledge Repository; ASEA Research & Training Platform in Partnership; CANSEA; GRET; GIZ; AFD, CIRAD, AFA; SEARCA; ASSET project; and ASEAN-SAS project. All types of study designs and publications following standard research methods from recognized institutions/experts were considered. The review considered literature published in the time frame 2000-2024.

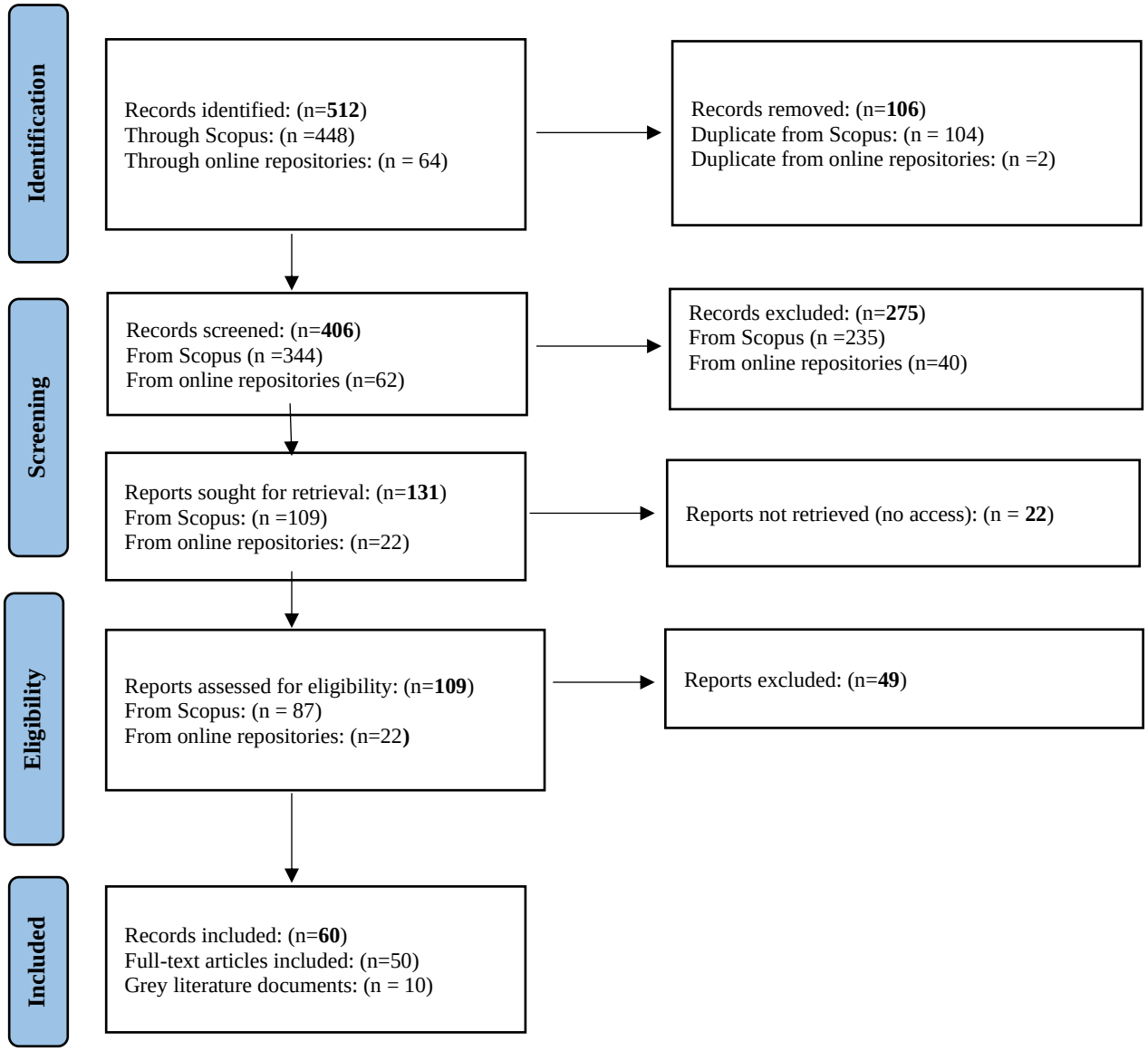

Figure 2 Flow Diagram representing the stepwise process of this review
Designed from: BMJ 2021; 372: n71

The search was performed in the Scopus database by combining search strings related to key search terms identified from relevant review articles on the topic (Mouratiadou et al., 2024; Wezel et al., 2014) and WorldVeg expertise. A total of three search strategies were undertaken: (a) to consider the selected agroecological practices with their impact on safe, healthy and sustainable diets, (b) to explore other related socio-economic and environmental effects of such practices, and (c) to consider the above and include terms at the political-economic level (see Annex 1 for details and search syntax).

In a preliminary search, we obtained 512 documents, of which, after removing duplicates, 406 were selected for screening on title, abstract and keywords. Exclusion criteria were: documents that did not assess the impact of any of the selected agroecological practices; documents from countries and commodities not included in the study; and records without access. Subsequently, copies of the full text of the documents were reviewed in depth, resulting in a further exclusion of 49 papers, as they misidentified agroecological practices, did not clearly indicate the source of the results, or did not provide any indication of the outcomes or indicators assessed. We also excluded laboratory experiments and modeling studies without actual field data. Of the 60 articles or reports selected, data were extracted using a standardized grid in Excel. The extracted information included (i) general identifying data (e.g. title, author(s), year of publication), (ii) the location of the study, (iii) the commodities studied, (iv) its emphasis on cross-cutting issues (e.g. gender, climate change), (v) the type of study and methodological approach, (vi) the agroecological practices and approaches, (vii) the impact on safe, healthy and sustainable diets and (vii) the inclusion of the 13 principles of agroecology, as well as any other relevant effects and impacts.

2.3 Expert consultations

Given the broad scope of the subject of agroecology and agroecological transitions in Southeast Asia, we adapted the HLPE's 13 principles of agroecology and developed a questionnaire following the principles while adjusting the questions to the needs of the study. The questionnaire focused on progress and gaps in agroecological transition, levels of evidence, successes and research priorities across the 13 principles. Over four hundred experts working on agroecology and related fields were identified through the literature review, internet search, and snowball sampling method (experts recommending other experts), and finally, 46 respondents (13 female and 33 male) who responded and agreed to be interviewed were consulted through virtual interviews (n=42) or by completing a questionnaire in Microsoft Word (n=4), based on their preference. Most of the experts were from local and regional NGOs (17), international research institutes (n=9), national or regional research and academic institutes (n=7), international NGOs (n=5), UN and intergovernmental organizations (n=6), and local government organizations (n=2). The collected information was analyzed anonymously and qualitatively according to the questions and themes.

3. Results

3.1 General overview of the literature

The search strategy yielded 50 peer-reviewed scientific articles (n=42 research articles; six conference papers, one working paper and one chapter) and ten non-peer-reviewed papers (three briefing notes, two project evaluations, four reports and one book). Around half of the included documents reported on findings from observational studies (n=28), while around one-quarter were experimental (n=12) and case studies[1] (n=10). Only two were systematic reviews: one on agroforestry and food security in Indonesia and the other on agroecological initiatives in the Mekong region. Almost three-quarters of included papers used quantitative methods (n=36), and the majority (n=32) were peer-reviewed papers. An overview of the included studies is given in Table. 1.

[1] By case studies, we consider articles that conducted an in-depth study of a specific case (e.g. a selection of a representative village or household.

Table 1 Summary of research types used by the reviewed studies

Type of research	Quantitative	Qualitative	Mixed method	Total
Observational	17 (16)	3 (3)	8 (8)	**28 (27)**
Experimental	11 (10)	0 (0)	1 (1)	**12 (11)**
Case study	4 (3)	5 (3)	1 (0)	**10 (6)**
Longitudinal	3 (3)	0 (0)	0 (0)	**3 (3)**
Review	0 (0)	3 (1)	0 (0)	**3 (1)**
Systematic review	0 (0)	2 (2)	0 (0)	**2 (2)**
Project evaluation	1 (0)	1 (0)	0 (0)	**2 (0)**
Total	**36 (32)**	**14 (9)**	**10 (9)**	**60 (50)**

Source: own calculations from reviewed literature. Note: in brackets peer-reviewed scientific studies

3.2 Geographic characteristics and commodities in the literature

The large majority of included papers reported on single-country studies (n=51), with nine cases located in multiple countries, including three from the Mekong Region of Southeast Asia (Myanmar, Laos, Cambodia, Thailand and Vietnam). Indonesia and Vietnam featured the highest number of cases (27 and 19, respectively), followed by Thailand and Myanmar with ten and nine cases, respectively, seven cases in Laos, six in Cambodia and five in the Philippines.

Not surprisingly, cereals, mainly rice, were the dominant crop (n=29) in all the agroecological areas studied (see Figure 3). Temporal and spatial diversification of cereal grains was observed through intercropping, mixed and multiple cropping, mainly combining rice with legumes and vegetables. They were also cultivated under integrated systems, particularly rice-fish farming systems (n=6), and under integrated crop-livestock (n=5).

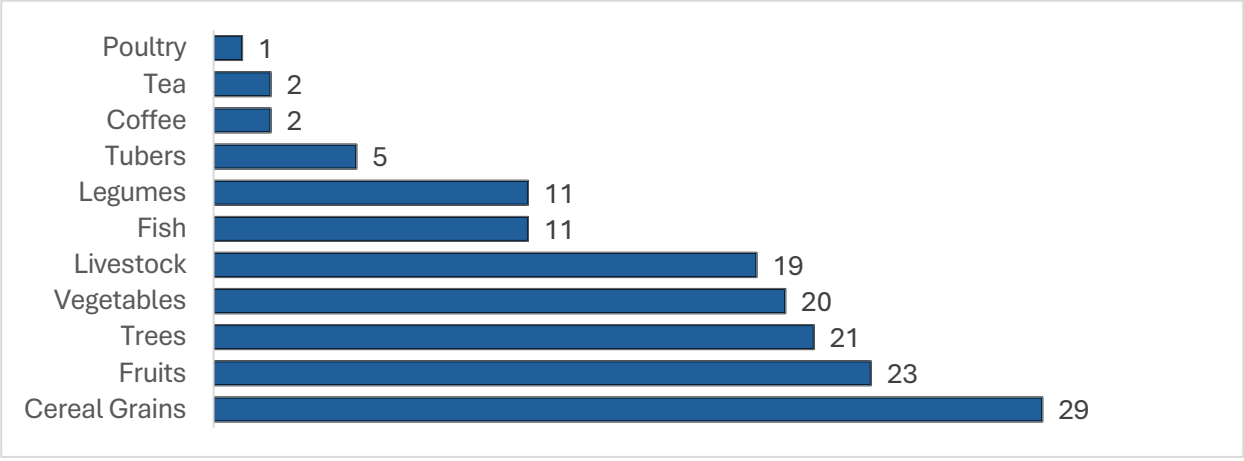

Figure 3 Commodities studied in the included literature.
Source: own calculation from reviewed literature

Cereals were followed by fruits (n=23), trees (n=21), vegetables (n=20) and livestock (n=19). Agroforestry, with multiple crops and, in several cases, grazing animals under the trees, was the dominant land use system studied. Legumes (n=11) were produced together with cereals (n=10) and other crops (n=6), such as vegetables, fruits or tubers, and in a few cases with livestock in integrated crop-livestock farming, and with fish and poultry in complex rice systems.

3.3 Agroecological practices at the farm and agroecosystem level

At the agroecosystem level, 56 of the selected publications studied at least one of the selected agroecological practice areas: 11 fell into the category of sustainable soil management, five studied integrated pest and disease management, and the majority (n=46) studied crop diversification and integrated farming systems (see Table 2). Only two scientific papers included a combination of two of these areas in the study, such as in both cases combining crop production or sustainable soil management practices with integrated pest management (IPM) strategies (Berg et al., 2017; Le VS et al., 2023).

Most of the included studies, around 80%, focused on integrated farming (n=34) or crop diversification (n=10). Integrated farming is a sustainable agricultural system that integrates livestock, crop production, fish, poultry, tree crops, plantation crops and other systems in a synergistic way so that the wastes of one process become the input for other processes for optimum farm productivity (Dar et al., 2018). Agroforestry, a land management approach in which trees and shrubs are integrated into agricultural and livestock systems with multiple benefits, is widely studied in the region (n=20). Of the agroforestry studies, n=11 refer to agrisilvicultural, and n=9 to agrosilvopastoral systems. Other relevant integrated farming systems were rice-fish (n=6) and crop-livestock (n=6). Crop diversification, defined as a process that makes a simplified cropping system more diverse in time and space by adding additional crops, included studies on intercropping of cereals with legumes (n=4) or legumes with tubers (n=1), mixed cropping of cereals with fruits and/or vegetables (n=3), multiple cropping (n=2) and complex rice systems (n=1).

Of the studies that looked at sustainable soil management practices, four focused on the impact of Conservation Agriculture (CA) practices and four looked at the impact of the application of organic inputs. This included the application of organic manure under the System of Rice Intensification (SRI), an agroecological practice to increase the productivity of irrigated rice. Individual studies were identified which evaluated regenerative agriculture (n=1), nutrient management (n=1), and the sustainable use of on-farm water resources (n=1).

Table 2 Subjects of studies included in the scoping study across the selected agroecological areas – Agroecosystem Level

Sustainable soil management	**11**
Organic inputs	4
Conservation agriculture	4
Water management	1
Regenerative farming	1
Nutrient management	1
Mixed practices	1
Integrated pest and disease management	**5**
Integrated pest management	5
Crop diversification and integrated farming systems	**46**
Agroforestry	20
Crop diversification	9
Rice-fish farming systems	6
Integrated crop-livestock farming	6
Farm diversification	2
Integrated livestock-fish farming	1
Complex rice systems	1
Crops-fish-husbandry farming system	1

Source: own calculations from the reviewed literature

Note: total values at aggregate level are the number of total studies, some had more than one agroecological practice.

3.4 Impacts of the adoption of agroecological approaches at the agroecosystem level

Most studies analyzed the economic and productivity effects (n=29) and diversification of farm income (n=23) of implementing agroecological practices, as well as their environmental impacts, mainly effects on soil health (n=21) (see Table 3).

Table 3 Impacts from adoption of agroecological practices

Outcomes related to the 13 principles of agroecology	**32**
Soil health	21
Economic diversification	13
Input reduction	6
Biodiversity	4
Animal health	2
Recycling	2
Synergies	1
Other outcomes	**29**
Household income	27
Productivity	7

Source: own calculations from the reviewed literature
Note: total at the aggregate level are the number of total studies, some had more than one outcome.

3.4.1 Economic impacts: diversification, reduced inputs, yields and income

The included studies showed how agroecological practices are a cost-effective approach to the sustainability of agri-food systems. Economic impacts were most commonly associated with increased productivity and income of smallholder farmers (n=29) and less frequently to reduced input costs (n=6). Adoption of sustainable soil management practices in Vietnam and Indonesia showed how regenerative agriculture and conservation agriculture increased farmers' incomes through higher yields and lower production costs (Le QV et al., 2021; Lastariningsih et al., 2021). The introduction of SRI in Cambodia enabled smallholder farmers to increase rice productivity with lower external input costs, while maintaining ownership of local seeds (IATP & AFA, 2011). Higher yields were also obtained in similar studies in Thailand and Indonesia through crop diversification with intercropping of food crops, hedgerow intercropping and cover crops, so that the increased income of resource-poor farmers made the investment of higher labor costs more feasible (Whitmore et al., 2000; Erythrina et al., 2022).

Studies on integrated farming also yielded positive economic outcomes. In Vietnam, for example, the additional fish yield from the adoption of integrated rice-fish systems resulted in 20% more gross income compared to rice-only farmers (Berg et al., 2017). The results of an experimental study in Myanmar show rice yields being sustained alongside 25 % economic returns from fish (Dubois et al., 2019). Complex rice systems and other organic systems were shown to reduce chemical and hazardous inputs while increasing food production and nutrition in small-scale rice production in Indonesia (Sparta et al., 2021). While combining agroecological practices such as rice-fish farming with IPM practices was associated with lower use of agrochemical inputs and higher net incomes, compared to rice monocropping in the Mekong Delta of Vietnam (Berg et al. 2002). A study by Sanglestsawai et al. (2015) examining the effect of the IPM-FFS model on onion farmers in the Philippines found a reduction in insecticide use, although found no evidence on outcomes such as yield or other input expenditures.

The effect of the adoption of agroecological practices on farm income diversification was included in 13 studies. In these studies, the adoption of crop diversification and integrated farming systems was reported to improve livelihoods. However, with integrated crop-livestock farming, one publication suggested that the benefits are only visible in the long term due to the high initial investments (Bahar et al., 2021). Kasem et al. (2011) found that farmers who diversified rice production with high-value crops such as vegetables in

Thailand had the ability to smooth the impacts of price fluctuation while facilitating the shift in crop combinations according to market demand. Livestock-based livelihoods can also be improved by diversification with high-value crops, including increased fodder production (Wani et al., 2012).

Multiple studies identified the important role of agroforestry systems in supporting farmers' livelihoods through diversification of household incomes (Njurumana et al., 2021; Do et al., 2024; Ferrand & Le Jeune, 2018; Khosada & Treboux Marion, 2018). Seruni et al. (2021) studied farmers in Indonesia who managed plots with a cut-and-carry agroforestry system, in which fresh fodder is brought daily to livestock, and concluded that it improved their financial resilience by limiting cash expenditures (e.g. lower livestock feeding costs) compared to those practicing cut-and-carry with monocropping practices. Herwanti et al. (2022), studying the role of agroforestry in small islands in Indonesia, found diversified farmers' incomes due to the presence of different types of cash crops. Finally, a study from Vietnam presented an integrated livestock-crop system that produces net zero GHG emissions which provides a sustainable livelihood, increases income by up to 42%, and reduces waste by recycling organic waste from livestock and crops (Than Hai et al., 2020).

3.4.2 Environmental impacts: soil health and biodiversity

Studies that examined environmental impacts were mainly related to improved soil health indicators (physical, chemical and biological indicators) of applying mostly sustainable soil management practices (n=10, e.g. de Putter et al., 2021, Le VS, 2021; Le VS, 2023; Bui et al., 2020) and integrated farming (n=8). Similarly, a systematic literature review of agroecological initiatives in the Mekong region revealed that most studies focused on improving soil quality and preventing erosion on agricultural land (Hett et al., 2023). For example, soil organic matter was shown to increase from the adoption of integrated livestock-fish farms in Thailand (Tipraqsa et al., 2007), and with the application of conservation agriculture in Indonesia (Lastariningsih et al., 2021), while SRI practices in Cambodia increased soil fertility (IATP & AFA, 2011). The only study on the effects of crop diversification on soil erosion revealed that it was relatively higher in cassava monoculture than in cassava intercropping systems in Indonesia (Iijima et al., 2004).

The positive impact of agroecological practices on biodiversity is well-sustained in the literature. Hett et al. (2023) in their systematic review of agroecological initiatives in the Mekong region found 69 cases, mostly in reference to the inherent linkage of agroecological practices with biodiversity conservation and sustainable use. However, this review found few cases (n=4) with positive effects of adopting agroecological practices. Promotion of biodiversity was demonstrated in several studies, including in Indonesia, where agroforestry played an important role in conserving biodiversity of flora, natural resources and the environment in Indonesia (Njurumana et al., 2021); in northern Vietnam, where leguminous intercropping systems positively contribute to restoring and maintaining soil biodiversity (Fouillet et al., 2021); and in the Central Highlands of Vietnam, where regenerative agricultural practices promoted biodiversity in a small ethnic minority village. Despite these positive examples, one publication highlights the negative impact of diversification and higher plant density to create microclimates that favor the growth of the Roya fungus, which could decrease crop yields (Le QV et al., 2021). A few experts mentioned limited availability of animal manure as one barrier to improving soil health and reducing the use of synthetic fertilizers. This is due to the intensification and shift from integrated systems to specialized farms, limiting direct access to manure as an input to crop production. The main exceptions to this trend are in Cambodia and Laos, where many farmers still raise cows, buffaloes, chickens and other livestock, and to a smaller extent oil palm plantations in Indonesia and Malaysia, where there is a trend towards raising cattle in the plantations to help manage ground vegetation, provide a natural source of fertilizer and a supplementary source of income.

3.4.3 Agroecological principles at the agroecosystem level that were under-represented in the literature: synergies, animal health and recycling

The capitalization of synergies between agricultural enterprises (e.g. aquaculture and livestock farming) in the use and reuse of resources was only addressed in one study, but the results suggest positive economic and environmental effects of adopting integrated farming (Tipraqsa et al., 2007). Similarly, animal health was addressed in only two studies, which provided evidence of the importance of ensuring animal health and welfare (Choocharoen et al., 2014; Khosada & Treboux, 2018). Only two studies examined nutrient recycling: one in Vietnam showed that nutrient recycling is an option to mitigate agri-environmental trade-offs in rice-fish farming systems by taking advantage of the high connectivity within the rice field ecosystem (Berg et al., 2023), and the other on crop-livestock systems through recycling and circulation of organic residues between livestock and crop production (Thanh Hai et al., 2020).

3.5 Impacts of agroecological approaches at the food system level

The literature review mostly found studies of agroecological approaches that are integrated at the agroecosystem level rather than the food system level, and just over a quarter of included studies reported impacts on food access or consumption. The studies focused mainly on food security (n=14), some of which also looked at dietary diversity (n=6). But it also found evidence on the relevance of promoting participatory processes (n=6) and institutional innovations (n=4) that help link producers and consumers and build mutual trust for co-creation and knowledge sharing (see Table 4).

Table 4 Impacts at the food system level

Outcomes related to the 13 principles of agroecology	**19**
Social values and diets, from which:	17
• Dietary diversity	6
• Food security	14
• Nutrition	2
Participation	6
Co-creation and knowledge sharing	4
Land and resource governance	3
Connectivity	2
Fairness	1

3.5.1 Safe, healthy and sustainable diets

Several studies examined the impact, or potential impact, of adopting agroecological practices on safe, healthy and sustainable diets. They focused mainly on one or more aspects of agroecology related to food security (including the four pillars of availability, accessibility, utilization and stability of food; n=14), household dietary diversity (n=6) and nutritional security (n=2; see Table 4).

According to several included studies, crop diversification and integrated farming systems promote sustainable food security and increase dietary diversity for members of farming households. Wider literature has indicated the relationship between production diversity and dietary diversity varies between settings, depending on the extent to which food production is oriented to home consumption or sale, the availability and affordability of foods for sale through local markets, and the socioeconomic position of households. Production diversity has been found to be important for reducing the risk of temporary food shortages (Frei & Becker, 2004). For example, agroforestry systems provide prospective food security through product diversification (Njurumana et al., 2021; Putra et al., 2022), while plant species diversity has implications for food provisioning services (Duffy et al., 2021). In Thailand, integrated farming systems outperformed commercial farming systems in terms of providing a more secure food supply, improving the resource base, creating greater economic benefits and meeting further needs as a provider of food materials, medicines, local rituals, tools and shading (Tipraqsa et al., 2007).

Optimizing land use through polyculture and integrated aquaculture can increase farmers' income, which not only stabilizes food access through the purchase of food products from additional income derived from fishing/cropping, but also increases dietary diversity directly through home consumption of products of different nutritional value (Pribadi et al., 2021, Mee et al., 2020; Wang et al., 2024). In fact, the dietary diversity of smallholder farmers is often increased by purchasing food from the markets as found in Laos (Parvathi, 2018). Nonetheless, dietary diversity of rural households is influenced strongly by household characteristics, such as farm size, when diets tend to be more diverse on smaller rural farms in the Mekong region (Tacconi et al., 2023). This suggests that production diversity is more critical in remote areas with limited market access. Access to home gardens is also associated with higher dietary diversity (Tacconi et al., 2023; Rammohan et al., 2019). A trade-off has been reported between dietary diversity and income between traditional and commercial agroforestry in the degraded peatland landscape of South Sumatra. Farmers with traditional home gardens had 20% higher dietary diversity despite commercial gardens providing five times more income (Winarno et al., 2022).

In addition, agroecological practices reduce the use of chemical and hazardous inputs, which increases the production of healthy and safe food (Sparta et al., 2021), and increases the nutritional output of agricultural lands as more diverse and nutritionally valuable plant- and animal-based foods are produced (Dubois et al., 2019; Sparta et al., 2021; Frei & Becker, 2004).

3.5.2 Participatory processes, knowledge sharing and co-creation

Different approaches for the active participation of farmers can be found in the literature. Participatory Guarantee System (PGS), for example, enables smallholder farmers to obtain certification of their products based on the active participation of stakeholders and are based on trust, social networks and knowledge sharing (Castella & Kibler, 2015; IATP & AFA, 2011; Ferrand & Le Jeune, 2018). A participatory land-use planning approach encourages community participation and involvement in the planning and innovation process (Khosada & Treboux, 2018). Developing agroecology models with organized group reflection meetings to discuss the methodology of the project activities and capitalize on the community's knowledge and practices (Ferrand & Le Jeune, 2018). Participating in a cooperative is identified as a way for farmers to gain market power, have more visibility, share knowledge and experience, and speak with a common voice that can contribute, for example, to awareness-raising campaigns on the dangers of pesticides (Ferrand & Le Jeune, 2018). Partnerships with public and private entities can enhance knowledge sharing, technical and entrepreneurial skills development, and innovations (Minh et al., 2024). Experts also highlighted the need to develop the capacity of national and local level universities and co-create new solutions with them.

3.5.3 Land and resource governance

Territorial and landscape approaches can facilitate the multi-stakeholder collaboration necessary for the effective implementation of sustainable development and landscape governance. In their systematic review, Hett et al. (2023) found 61 studies related to improving food systems through innovative territorial governance initiatives, mainly participatory land-use planning. However, we only found two examples that consider the impacts of good land and natural resource governance. The evaluation of a project in Laos indicated that participatory land-use planning is a slow process but one that fosters ownership and capacity building at the community level (Khosada & Treboux, 2018). A case study on community seed banks found food producers as sustainable managers and stewards of natural and genetic resources (Ferrand & Le Jeune, 2018), but the long-term sustainability of these initiatives is not known.

3.5.4 Agroecological principles at the food system level that were under-represented in the literature: social values, fairness and connectivity

The importance of building food systems based on the social values of local communities (n=1) and fairness for the actors involved (n=1) was little addressed in the studies but with positive conclusions. For example, a study on the socio-ecological dimensions of agroforestry in Indonesia concluded that land ownership

places the farmer in a higher social position (Withaningsih & Rozi, 2021), indicating that supporting smallholders and indigenous communities to secure their land tenure and ownership as part of agroecological approaches could enhance social and sustainability outcomes. When looking at certification schemes, the report by IATP & AFA (2011) concluded that with PGSs, farmers can get a fair price for produce. Likewise, connectivity (n=2) was also rarely included within the literature, for example, in a case study on Rikolto's organic PGS activities in Hanoi mentioned that the strong connection of farmer groups to markets enabled farmers to earn a stable income that has sustained their engagement throughout the years (Ferrand & Le Jeune, 2018).

Experts agree that access to the market is a key constraint for agroecological transition. Demand for organic and agroecological produce remains extremely limited with most consumers choosing conventional produce because it is cheaper and looks better. There are some exceptions, such as in parts of Malaysia and Thailand, Bali, Yogyakarta and some major cities in Java, Indonesia, Siem Reap in Cambodia, Vientiane in Laos, Negros Occidental and several major cities in the Philippines, and Yangon in Myanmar, where the establishment of farmers markets and fresh food networks has led to modest demand for organic food. However, even in major tourist areas such as Bali and Siem Reap, smallholder organic and agroecological farmers have found it difficult to establish supply contracts with hotels, restaurants and supermarkets because they cannot guarantee a continuous produce supply in the required volume and quality.

Experts acknowledged that organic, sustainable agriculture, fair trade and other certification schemes remain prohibitively expensive to a majority of smallholder producers and offer only a marginal premium. As such, certification is restricted mainly to medium and large-scale producers, tough in some areas, NGOs and farmer organizations or cooperatives have promoted group certification for smallholder farmers. The EU Deforestation Regulation, RSPO and other supply chain verification schemes similarly better suit medium and large-scale producers, which may unintentionally disadvantage smallholders unless external support is provided.

Most experts felt that the PGS is a promising alternative to certification. This approach has the advantages of building relationships of trust between producers and consumers as well as facilitating knowledge transfer. However, most respondents agreed that the PGS is heavily dependent on donor funding and lacks a long-term strategy to become self-funding. As such, research into how to strengthen the PGS in different countries and how to make it financially independent was identified as a priority.

Reorganizing supply chains to cope with a greater range of agricultural products with a shorter shelf life to ensure that produce reaches markets and consumers in a timely manner is also a crucial and under-researched factor, probably constrained by logistical and technological requirements. Peri-urban production of agroecological vegetables near larger cities with growing demand for healthy food could represent an opportunity for improvement and scaling of schemes such as PGS.

3.6 Agroecology and climate change

According to consulted experts, agriculture and land-use change are major sources of greenhouse gas (GHG) emissions in Southeast Asia. Indonesia in particular is considered one of the largest emitters of GHGs in the world, largely due to the expansion of oil palm and other forms of plantation agriculture. All Southeast Asian countries are highly vulnerable to the impacts of climate change and there is growing awareness of the environmental, health and economic costs associated with climate-related disasters.

For example, major forest fires in Indonesia in 2015, 2019 and 2023 are estimated to have cost Indonesia billions of dollars, had widespread health and social impacts, and damaged relations with neighboring countries. Major droughts extending across Cambodia, Thailand and Central Myanmar in 2000, 2004, 2005, 2010, 2016, 2019, and 2020 have also had a very negative effect on both GDP and farmer livelihoods.

More frequent heatwaves, longer heatwave duration, and higher extreme temperatures during heatwaves are predicted to occur throughout Southeast Asia, with record-breaking temperatures recorded from

Myanmar to Vietnam in 2024. Severe storms, such as Super Typhoons Haiyan in 2013, Meranti in 2016, Goni in 2020 and Yagi in 2024, have resulted in casualties and destruction across the Philippines and Vietnam. Sea level rise threatens agriculture in coastal areas, particularly in the island nations of Indonesia, the Philippines, the Mekong and Irrawaddy deltas, and coastal areas of Thailand, Vietnam, Java and South Sulawesi, where mangroves and coastal forests have largely been converted to aquaculture and rice cultivation. According to experts, these disasters have raised attention and awareness amongst ASEAN political leaders regarding the urgent need for action on climate change.

Based on the discussions, the Philippines is probably the Southeast Asian country most vulnerable to climate change, particularly the increased frequency and intensity of typhoons. Work is underway in the Philippines to improve long-term weather forecasting to provide an early warning system to help farmers better plan their production and prepare for extreme weather events. Efforts are also underway to reform the national agricultural insurance scheme to assist farmers with post-disaster recovery. CIFOR/ICRAF and other organizations have also been working on agroforestry systems to help prevent soil erosion and landslides in upland areas. However, the Philippines does not seem to transition to agroecological future, probably due to frequent disasters and the need of farmers to maximize and fasten the production between the typhoons.

Looking at the literature, only n=9 studies considered the impact of agroecological practices on climate change adaptation, mitigation and resilience. Studies showed that integrated rice-fish farming increases farmers' adaptability to climate change due to a more balanced use of multiple ecosystem services (Berg et al., 2017), and its contribution to ecosystem maintenance and resilience (Freed et al., 2020), benefiting farmers' health, economy and environment.

Agroecological practices, such as regenerative practices, conservation measures and agroforestry, can mitigate climate change. Regenerative agricultural practices preserve the ecological integrity of the landscape while improving productivity and economic performance of coffee production (Le QV et al., 2021). Bui et al. (2020) evaluated a 17-year climate mitigation program of cassava-based soil conservation practices on sloping land in Vietnam and found improved vertical water infiltration rates and considerable improvement in soil fertility. And Manilay et al. (2022) measured the economic benefits of introducing a fruit-tree based system suitable for drylands in Myanmar and found that it was an economically viable means of mitigating the negative impact of climate change on agriculture-based livelihoods. A study by Thanh Hai et al. (2020) demonstrated that integrated and circular livestock-crop farming can increase productivity and income while reducing waste and greenhouse gas emissions (GHG) in Vietnam.

Several examples in the literature suggest that agroecological practices contribute to increasing resilience to climate change. For example, the additional indirect food security benefits of agroforestry systems (e.g., home gardens) strengthen smallholder farmers' stability and resilience to environmental shocks such as floods or droughts (Duffy et al., 2021). Agroecological social initiatives in the region, such as farmers' field schools or participatory land-use planning, respond to the challenges of environmental degradation and climate change impacts in a more inclusive way (Ferrand & Le Jeune, 2018; Khosada & Treboux Marion, 2018). One expert from Indonesia mentioned a farmer field school concept changed to "climate field school" indicating a shift of focus towards practical learning on climate-resilient agriculture.

3.7 Agroecological practices, gender and social inequality

We found several cases (n=11) in the literature looking at gender dimensions or gender-sensitive agroecological approaches and innovations. Some studies concluded that women's participation can help spread agroecological innovations to a wider audience through their social networks (e.g., Mai Phuong et al., 2021), and that successful participation is more likely when initiatives are complementary or an extension of existing gender roles. (Hett et al., 2023). Men tend to play a greater role in management and decision-making on agricultural practices (Wulandari & Djufry, 2021; Bui et al., 2020), while women still have limited access to resources such as land and capital, technology, training and marketing services

(Reyes, 2008). Nevertheless, both men and women consider economic benefits to be the main consideration for crop selection, along with other aspects of welfare, i.e., regulatory services and food security (Ureta et al., 2016). According to a review by Tacconi et al. (2023), gender does not have a significant impact on the drivers of farm diversification, nor on the dietary diversity of the households (Parvathi, 2018). But there are gender differences in relation to risk concern; for example, a study on herbicide uses in Laos reported that women who expressed more concern about men's herbicide poisoning risks were more likely to adopt agroecological initiatives (Hett et al., 2023).

Some literature and experts suggested that the rights of Indigenous women and girls are a matter of great concern because they suffer disproportionately from social, economic and political marginalization and discrimination, but also because, if given the opportunity, they are often effective agents of change within their communities. Especially in relation to food production and protecting the natural environment, Indigenous women tend to be more directly dependent upon natural resources, possess deep agroecological knowledge, and usually suffer more severely as a result of alienation from land and resources.

3.8 Status of agroecological transition in Southeast Asia according to the experts

The majority of experts conveyed that only limited or moderate progress has been made in terms of agroecological transitions in Southeast Asia. Cambodia and Vietnam were often mentioned as the countries with the highest probability of achieving agroecological goals in the next two decades due to ongoing progress and plans for action.

Experts mentioned that the key drivers of policy shifts towards agroecology include growing concerns regarding:

- The environmental, health and economic costs associated with climatic disasters.
- Recent economic shocks and the impact thereof on the prices of food and agricultural inputs.
- Increasing regulation of export through mechanisms such as the European Union Deforestation Regulation (EUDR), and Round-table on Sustainable Palm Oil (RSPO).
- The impact of overuse of agrichemicals on the health of producers and consumers, as well as the soils, water and pest populations

When discussing the barriers, experts mentioned policies favoring conventional production, lack of knowledge and experiences among farmers, time requirements and risks associated with new practices, poor market access, and limited national budgets for R&D support towards agroecology. A few other barriers were identified in the literature, i.e. high initial costs of adopting agroecological practices, limited market access and no market differentiation for agroecological products, and the high price of third-party certification processes for organic or alternative labels.

Several respondents pointed out that outside of the Lower Mekong Countries (LMCs - Cambodia, Laos and Vietnam), it is difficult to evaluate the progress towards the transition because agroecology has not yet been adopted into their sustainable development planning frameworks and thus, there are no specific agroecology targets or indicators which can be used to measure progress towards it.

Experts mentioned that the financial and technical support from the UN, development banks, bilateral donors, international NGOs, and agricultural research institutions makes a difference and drives the shift to agroecology and related policy changes.

Recently, for example, the ASSET project, members of the ALiSEA network and other partners have helped to facilitate multi-stakeholder collaboration and conducted field activities and assessments in flagship provinces in Cambodia, Laos and Vietnam (Kim & Peeters, 2020; Diepart & Kong, 2022; Huyen et al., 2021, respectively) to promote and plan for the adoption of agroecology and the development of supporting policies at a national scale. Myanmar was also involved in this process, but since the 2020 military coup, their involvement in these processes has been seriously constrained.

In October 2022, members of the ALiSEA network, the ASSET project team and government partners convened a series of "National Foresight and Theory of Change Workshops " at the national level in Lao PDR, Cambodia and Vietnam (ALiSEA, 2024). These workshops applied the "Vision to Action (V2A)" approach for participatory planning of agroecological transitions in the living landscapes to develop a shared vision and pathways towards desirable agroecology futures in each country through a participatory or co-creative process that was open to all stakeholders engaged in Agroecology, including ALiSEA members and non-members. The main outputs from these workshops are documents outlining the "Vision for Agroecological Transition (AET)" in Cambodia, Lao PDR and Vietnam as well as intervention pathways and indicators for measuring progress toward Agroecological transition (ASSET & ALiSEA, 2023). See Box 1 for an example of a Vision for Agroecological Transition in Cambodia.

Elements of these plans are in the process of being incorporated into national policy and planning frameworks, and whilst still not fully integrated, these documents provide a valuable tool for measuring progress towards the transition in Cambodia, Lao PDR and Vietnam, which is sadly lacking in other countries in Southeast Asia.

From a regional policy perspective, there have recently been some encouraging policy developments, including the promulgation of ASEAN guidelines on “Soil and Nutrient Management” in 2017, for "Agroforestry Development” in 2018, and for "Sustainable Agriculture" in 2022.

In the current context of rapidly changing global markets, ASEAN member states face serious challenges, balancing their dependence on export markets and the need for protectionist strategies to defend their domestic markets and prevent social unrest due to rising food prices. Key patterns that have emerged in the trade-related policies and practices of ASEAN member states over the past few years include:

- Fewer trade transactions between ASEAN member states;
- More dependence on external / non-ASEAN trade partners, most notably China, which is the largest trading partner for Cambodia, Laos, Indonesia, Malaysia, Myanmar, Singapore, and Vietnam and increasingly with Brunei, the Philippines and Thailand as well, with trade relations predicted to strengthen in the coming decade;
- The so-called 'spaghetti bowl phenomenon', which is characterized by a growing number of overlapping and sometimes conflicting bilateral and regional trade agreements; and
- Emerging trends in protectionism and resource nationalism.

Furthermore, the current restructuring of global trade and supply chain networks and the rising competition between great powers have placed Southeast Asia near the epicenter of the US-China trade conflict. As such, it appears that whilst the coming decades may present new opportunities for trade, it also risks deepening the divides within ASEAN, with Laos and Cambodia more closely aligned with China than other ASEAN members, risks of further trade disruption and inflation in the prices of food, fertilizers and other agricultural inputs, imposition of new tariffs and trade restriction, and even risks of ASEAN member states being drawn into a future conflict.

Box 1. Vision for Agroecological Transition (AET) targets in Cambodia by 2040

In 2023 members of the ASSET & AliSEA networks formulated a vision for 2040 which embodies a commitment to agroecology as a catalyst for transformative change, and defined the goals of AET in Cambodia.

1. Improved agroecological knowledge and practice among farmers & other stakeholders:

- 75% of Cambodian farmers increase their knowledge on agroecology, 50% actively practice it.
- Agroecology is the cornerstone of the agricultural approach, embedded in extension services, universities, and technical and vocational education and training (TVET), supported by a robust policy framework and digital tools.

2. Establishment of inclusive and trust-based agroecological market platforms:

- Dedicated platforms have been established to coordinate production, market activities, and capacity needs within specific agroecological value chains. These platforms are legally recognized and financially sustainable.
- Active participation in these platforms is ensured for all essential stakeholders, encompassing producers, the private sector, and consumers.
- Equal representation and negotiation powers are afforded to women and youth. The platforms promote the development of agroecology as a successful and fair business based on trust among all stakeholders.

3. Localization of markets guided by principles of circularity, fairness, self-sufficiency, and affordability:

- At least 35% of consumers will afford agroecological products, and farmers will consume a portion of their agroecological production.
- Approximately 70% of the production is sold in short market circuits (from zero to three intermediaries) involving farmers organizations engaged in trust mechanisms with consumers;
- Fair pricing for agroecological products, determined by farmers themselves, characterizes these trust mechanisms, with ready access to information on stock and price fluctuations. Oversight by the Ministry of Commerce ensures equity and balance.

4. Establishment of agroecology-friendly policies:

- Comprehensive policy measures provide unwavering support for all facets of agroecological food system.
- Incentives facilitate the transition of farmers and cooperatives to agroecology, while the availability of extension services and local advisors caters to the needs of AE farmers.
- Mandatory public procurement of agroecological products established by law, including within public school feeding programs, promotes widespread adoption of agroecological practices.
- Existing platforms, particularly CASIC, serve as effective vehicles for amplifying the message and benefits of agroecology.

5. Advanced healthier food policies and awareness:

- Commitment to healthier food policies will include rigorous regulations for domestic and imported products, with a focus on providing information regarding agricultural practices (chemical, agroecological..) and nutritional content, prevent fast-food and promote diverse local foods based diets.
- Empowered consumers will have access to information about the health implications of their food choices, and to affordable quality and healthy options.
- Development of evidence-based policies that take into account the connection between food and health.
- Cooperatives will process their production surpluses to reduce food losses and safety issues, while also enabling them to directly sell fresh and processed products to consumers.

6. Efficient resource utilization and renewable energy adoption:

- Cambodia takes a pioneering role in sustainable resource management.
- Wastewater from factories and urban areas undergoes treatment, mitigating adverse effects on agriculture.
- Technological innovations harness ecosystem services, emphasizing the promotion of renewable energy
- Commitment to efficient water irrigation, infrastructure, and fair governance guarantees stable access to water and reduces maintenance costs for agricultural production for all including youth, women, small-scale farmers.

Source: ASSET & AliSEA (2023b) "An Agroecological Cambodia by 2040." Position Paper, October 2023
https://www.asset-project.org/content/download/5019/37511/version/5/file/Position+Paper_ToC_Cambodia.pdf

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In this context, it is likely that ASEAN and its member countries are pursuing a dual pathway approach to agricultural development policies. Whilst agroecology, agroforestry and similar approaches have been valorized as a way to achieve food security, improved livelihoods and reduced environmental impacts in marginal areas, policymakers still firmly embrace further intensification through hi-tech approaches involving precision agriculture, mechanization, automatization and biotechnology, to achieve further productivity gains in core agricultural areas. While several of the principles of agroecology, such as recycling, reduced inputs, soil health, IPM, and sometimes integrated production are being combined with the hi-tech approach, overall, broader social and environmental goals of agroecology are rather neglected.

Whilst such a dual pathway approach may be viewed as pragmatic policymaking, which attempts to balance national goals of food security, export growth and NDCs/GHG emission reduction targets, against the broader societal goals of balancing productivity with sustainability and inclusivity, there are certainly instances where agroecology is used for greenwashing and to maintain the dominance of agri-business.

Regardless of how we view such policy compromises, it is clear that a considerable amount of entropy and deeply entrenched attitudes amongst policymakers will need to be changed before agroecology can become the dominant paradigm throughout the region. Here, the crucial role of research, development, and living examples of successful regional initiatives becomes evident.

3.9 Research gaps, priorities, and recommendations

As numerous suggestions for research ideas and development actions have been mentioned in the respective sections throughout the results above, below is a summary of the main research gaps, priorities and recommendations for a future research program:

- A majority of studies identified through our review and stakeholder consultation tended to focus on single agroecological practices or principles, with few assessing the integration of multiple practices or principles. Some agroecological principles were identified to have received limited research attention.
  - **Recommendation:** Support studies examining the effects of integrating agroecological practices, and projects with multiple components, to address multiple challenges. These may be compared with single-component approaches to understand cost-effectiveness.
  - **Recommendation:** Consider prioritization of under-studied agroecological principles, related to the agroecosystem level (synergies, animal health and recycling) and the food systems level (equity, connectivity and social values).

- There is evidence of the positive effects of integrated production systems on productivity, environmental management and household food security, but further guidance on how best to design and implement such systems is needed. This includes finding ways to reverse ongoing soil and water degradation in farms that have transitioned to monocultures.
  - **Recommendation:** Pursue opportunities to optimize integrated production systems to increase their competitiveness, resilience and circularity, building on their known economic, environmental and food security benefits.

- Innovations are most commonly studied through controlled field trials or in well-managed single-site studies. More research is needed on how insights can be applied within real context, larger programs, and alongside efforts from other stakeholders to achieve impact at scale.
  - **Recommendation:** Pilot more transformative research and development approaches, including cross-sectoral approaches, integration at scale and multi-stakeholder collaboration between research and practice. Ensure pathways to transformation are robust and clearly defined in proposals.

- Cereal and commodity-based cropping systems diversified with legumes and vegetables were found to have multiple wins, with positive impacts detected on income and food security, however, evidence comes from a few studies.

- **Recommendation:** Continue to support projects that incorporate legumes and vegetables into cereal and commodity-based cropping systems, and explore the potential of less-studied commodities (e.g. spices) in diversifying systems.

- Pathways from agricultural production to nutrition have been shown to vary between contexts, with decision-making about the sale and purchase of food products varying based on household and market factors. This is also the case with agroecological systems.
  - **Recommendation:** Build understanding of how the impacts of agroecological systems vary according to household characteristics and between settings, to inform the design of context-appropriate programs and policies, and deliver clear recommendations and guidance to farmers, policymakers, and industry.

- Most of the agroecological studies in Southeast Asia identified through this literature review and stakeholder consultation focused on cereal crops (mainly rice), fruits, and trees.
  - **Recommendation:** Widen the scope of agricultural commodities under investigation, to include legumes, vegetables, tubers, spices, fish, poultry, and livestock.

- Adopting sustainable soil management practices is known to have generally positive environmental and productivity effects, with evidence of impacts on a range of biophysical indicators (e.g. soil fertility, carbon content, crop productivity etc.). In contrast, few studies have considered impacts on economic, nutritional or resilience outcomes for households.
  - **Recommendation:** Address knowledge gaps on whether good soil management and regenerative agriculture can achieve positive impacts on livelihoods, food security, diet quality or nutrition, in addition to demonstrated biophysical and environmental benefits.

- While comprehensive adaptation of agriculture to climate change is crucial in this vulnerable region, little is known about the potential of agroecology to also contribute to reducing greenhouse gas emissions and climate change mitigation.
  - **Recommendation:** Address a major knowledge gap on the potential of agroecology to reduce greenhouse gas emissions and contribute to climate change mitigation.

- The impacts of agroecology and related interventions on women, youth, indigenous communities and vulnerable groups has not been well-studied. There is also limited evidence of how gender and social differences may mediate opportunities to engage in and benefit from agroecological production systems.
  - **Recommendation:** Pursue lived experience research to understand the perspectives of and impacts of agroecological interventions on women, youth, indigenous communities and vulnerable groups. Use research insights to inform best-practice guidelines to support inclusion and equity.

- According to experts, the Participatory Guarantee System (PGS) scheme offers a promising alternative to formal certification schemes which is inclusive of smallholder producers.
  - **Recommendation:** Support the PGS scheme in more Southeast Asian countries and explore ways to make the scheme financially independent.

- Territorial and landscape approaches, bottom-up processes, and living labs are suggested as alternative ways in which to pursue agroecological research and innovation. There is a consensus that enabling stronger and more inclusive participation of communities and "co-creation" of agroecological solutions will result in more locally relevant innovations, higher adoption, and greater impacts, but there is a need for rigorous evaluation of such approaches.
  - **Recommendation:** Strengthen the evidence base on the impact of participatory and community-led research approaches, including by testing the feasibility and cost-effectiveness of territorial and landscape approaches, bottom-up processes and "living labs".

- National and regional networks, such as the Agroecology Learning Alliance in South East Asia (ALiSEA), appear highly beneficial for knowledge exchange, advocacy, and driving the transition, but their sustainability is often subject to funding and external support.
  - **Recommendation:** Strengthen existing national and regional networks, and support expansion of those with a limited presence to reach out to more countries and regions.
- There is limited evidence about the economic, environmental and health impacts of agroecology-related policies and programs.
  - **Recommendation:** Support impact evaluations of agroecology-favoring policies and programs, both for previous and future initiatives. These should be linked to the implementation of governmental programs or large projects or initiatives to inform policymakers. This will require investment and effective study designs to consider outcomes over differing time scales and contexts in a robust manner.

4. Key stakeholders engaged in agroecology research and development

The search strategy helped to identify key stakeholders involved in agroecology research and development through authorship, funding and implementation of initiatives. Many of these were found in the ALiSEA network repository through the search for agroecological activities in agroforestry, conservation agriculture, IPM and integrated farming systems, organic agriculture and system of rice identification. Most of the participating organizations are development organizations and research institutions, while governmental institutions and civil society organizations are few (n=9 and n=7, respectively). A list of the key stakeholder organizations identified through the literature review is provided in Annex 2.

Agroecological practices have expanded and gained visibility in Southeast Asia, thanks to the support of funding organizations and research institutions, particularly in the Mekong region. According to the literature reviewed, the most prominent international funding institutions are:

- Australian Agency for International Development (AUSAID; for which responsibilities were transferred to the Department for Foreign Affairs and Trade in 2014)
- Australian Centre for International Agricultural Research (ACIAR)
- Consultative Group on International Agricultural Research (CGIAR)
- Danish International Development Agency (DANIDA)
- Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH
- European Union (EU)
- Food and Agriculture Organization of the United Nations (FAO)
- French Development Agency (AFD)
- French Facility for Global Environment (FFEM)
- International Fund for Agricultural Development (IFAD)
- Oxfam International
- Swedish International Development Cooperation Agency (SIDA)
- Swiss Agency for Development and Cooperation (SDC)

Experts mentioned international support through multilateral organizations mainly in the Mekong region, including from ADB, CIRAD, FAO, IFAD and international NGOs, including GRET and Swisscontact supported agroecology initiatives including Agroecology for Southeast Asia (ASEA), The Agroecology Learning Alliance in Southeast Asia (ALiSEA), Markets and Agriculture Linking Chains in Asia (MALICA), the Laos Initiative in Conservation Agriculture (LICA), and a multi-component project called Agroecology and Safe Food System Transitions (ASSET) financed by the AFD and the European Union.

The most active research institutes that have contributed to the agroecological transition in the region (based on the published studies[2]) are mainly:

[2] Specifying research institutes based on the published studies might favour international and publication-oriented institutes.

- World Agroforestry Center (ICRAF)
- Alliance of Bioversity and International Center for Tropical Agriculture (CIAT)
- Centre de coopération internationale en recherche agronomique pour le développement (CIRAD)
- Cornell University
- Northern Mountainous Agriculture and Forestry Science Institute (NOMAFSI) in Vietnam

These international institutions implemented their activities through government agencies in different countries and have organized regional networks with the support of international networks like ALiSEA or CANSEA (Castella & Kibler, 2015). Although national universities did not emerge from the literature review as prominent actors supporting the agroecological transition, interviewed experts often highlighted the importance of collaboration and partnerships with leading local universities. All relevant academic and research institutes are mentioned in annexes.

5. Conclusions

This scoping study examined existing evidence and expert opinions to gain insights on the impacts and future directions for agroecological transition to climate-resilient, equitable and nourishing food systems in Southeast Asia. Crop diversification, such as intercropping of cereals with legumes and/or vegetables or agroforestry systems, and integrated farming systems, such as rice-fish and crop-livestock farming, are all agroecological practices with positive impacts associated with most of the 13 principles of agroecology and sometimes also with higher economic returns and climate resilience. Integrating multiple agroecological practices and principles in local landscapes will likely better address multiple challenges smallholders face compared to single practices or solutions, yet there is a need for greater evidence, especially related to synergies, trade-offs and costs.

Our study found that while there are some agroecological principles that are commonly studied, these are typically at the farm level and there is little evidence on a few principles related to the agroecosystem level (synergies, animal health and recycling) and the food systems level (equity, connectivity and social values). We also detected a weak emphasis on climate change, especially regarding the limited quantification of evidence on climate change adaptation, mitigation or resilience outcomes. Future efforts should also better understand the impact of agroecology on gender and social differences, and develop guidelines to support inclusion and equity. Addressing real barriers and identifying behavioral determinants of agroecological adoption can help formulate successful technology transfer and adoption strategies. While there is no quantitative evidence that participatory approaches and co-creation of solutions achieve greater impacts, experts generally agree that inclusive participation and involvement of communities in the innovation process is critical for the successful adoption of agroecological solutions to ensure these align well with local priorities, constraints and opportunities.

Additionally, more transformative multi-stakeholder initiatives should be piloted between farmers, researchers, private sector and other stakeholders. National and regional networks such as ALiSEA appear highly beneficial for knowledge exchange, collaboration, advocacy and for driving the transition. These networks should be sustained and expanded where they are not yet present. There is still a long way to go for a large-scale agroecological transition in the region, with experts agreeing that only limited or moderate progress has been made to date. While more studies in the literature came from Indonesia, Vietnam, and Thailand, experts agreed that currently, agroecologically progressive countries are Cambodia, Vietnam, and Laos. Efforts in these countries should continue to share experiences and lessons within the region and make them leading examples. Nevertheless, other countries should not be left behind the opportunity to benefit from agroecological approaches and their potential to strengthen climate resilience. As highlighted by experts, financial and technical support will be critical to raising local capacities, initiating action, and driving change.

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Online repositories

Agence Française de Développement (AFD) : https://www.afd.fr/en/ressources-accueil

Agroecology and Safe Food System Transition in Southeast Asia (ASSET): https://www.asset-project.org/publication

ASEAN Sustainable Agrifood Systems (ASEAN SAS) project: https://www.asean-agrifood.org/publications/

ASEA-Network: https://www.asea-network.org/publication

Asian Farmers' Association for Sustainable Rural Development (AFA): https://asianfarmers.org/category/resources/publications/

CGIAR repository: https://cgspace.cgiar.org/home

CIRAD open repository of publications: https://agritrop.cirad.fr/

Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ): https://publikationen.giz.de/esearcha/browse.tt.html

FAO Knowledge Repository: https://openknowledge.fao.org/home

Landscape Management and Conservation Agriculture Development for Eco-Friendly Intensification and Climate Resilient Agricultural Systems in Lao PDR (EFICAS project): https://www.eficas-laos.net/resources/reports

Professionals for Fair Development (GRET): https://gret.org/en/publications-2/

Southeast Asian Regional Center for Graduate Study and Research in Agriculture (SEARCA): https://www.searca.org/pubs

The Agroecology Learning alliance in Southeast Asia (ALiSEA: https://ali-sea.org/online-library/

Annexes

Annex 1. List of acronyms

ACIAR	Australian Centre for International Agricultural Research
AFA	Asian Farmers' Association for Sustainable Rural Development
AFD	Agence Française de Développement
ALiSEA	Agroecology Learning Alliance in Southeast Asia
ASEA	Agroecology in Southeast Asia
ASEAN-SAS	Association of Southeast Asian Nations Sustainable Agrifood Systems
ASSET	Agroecological and Safe Food System Transitions
AUSAID	Australian Agency for International Development
CANSEA	Climate Action Network Southeast Asia
CA	Conservation Agriculture
CEDAC	Center for Studies and Development of Cambodian Agriculture
CGIAR	Consultative Group on International Agricultural Research
CIAT	Center for Tropical Agriculture
CIRAD	Centre de coopération internationale en recherche agronomique pour le développement
CRS	Complex Rice System
DANIDA	Danish International Development Agency
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FFEM	French Facility for Global Environment
FFS	Farmer Field School
FNN	Farmer Nature Net
GIZ	Gesellschaft für Internationale Zusammenarbeit
GHG	Greenhouse gas emissions
GRET	Professionals for Fair Development
IATP	Institute for Agriculture and Trade Policy
ICRAF	World Agroforestry Center
IFAD	International Fund for Agricultural Development
IFS	Integrated farming system
IPM	Integrated Pest Management
HLPE	High-Level Panel of Experts on Food Security and Nutrition
MIID	Myanmar Institute for Integrated Development
MIPAD	Mondulkiri Indigenous People's Association for Development
NOMAFSI	Northern Mountainous Agriculture and Forestry Science Institute
NGO	Non-governmental organization
PICO	Population-intervention-comparator-outcomes
PGS	Participatory Guarantee System
PRISMA	Preferred Reporting Items for Systematic Review and Meta-Analysis
RRMG	Rapid Reviews Methods Group
SEARCA	Southeast Asian Regional Center for Graduate Study and Research in Agriculture
SDC	Swiss Agency for Development and Cooperation
SIDA	Swedish International Development Cooperation Agency
SPERI	Social Policy Ecology Research Institute
SRI	System of Rice Intensification
WorldVeg	World Vegetable Center

Annex 2: Search syntax applied in the rapid literature review

***Search Combination A*: Agroecosystem – Food systems levels (safe, healthy and sustainable diets):**

("agrobiodivers*" OR "agro-biodivers*" OR "agrifood system*" OR "agri-food system*" OR "sustainable agricultural system*" OR "agroecolog*" OR "agro-ecolog*" OR "sustainable soil management" OR "nutrient management" OR "integrated nutrient management" OR "nutrient cycling" OR "soil health" OR "regenerative agriculture" OR "cover crop*" OR "green manure*" OR "management of landscape elements" OR "tillage management" OR "water management" OR "weed management" OR "crop-soil system*" OR "integrated soil fertility management" OR "crop fertilization management" OR "conservation agriculture" OR "integrated pest and disease management" OR "integrated pest management" OR "agroecological pest management" OR "integrated disease management" OR "crop diversity" OR "crop diversification" OR "crop system diversification" OR "diversified cropping system*" OR "integrated farming system*" OR "mixed farming" OR "mixed cropping" OR "intercropping" OR "diversified farming system*" OR "crop rotation*" OR "agroforestry" OR "polycultures" OR "conservation agriculture" OR "crop-livestock") AND ("food system*" OR "food hub" OR "safe diet*" OR "healthy diet*" OR "sustainable diet*" OR "dietary diversity" OR "dietary diversification" OR "food security" OR "nutritional security" OR "food access" OR "food biodiversity") AND ("vegetable*" OR "legume*" OR "pulses" OR "livestock" OR "cereal*" OR "fruits" OR "tubers" OR "poultry" OR "fish") AND ("South-east Asia" OR "Southeast Asia" OR "Thailand" OR "Cambodia" OR "Laos" OR "Vietnam" OR "Philippines" OR "Indonesia" OR "Myanmar" OR "Burma")

***Search Combination B:* Agroecosystem – Food systems levels (other outcomes):**

("agrobiodivers*" OR "agro-biodivers*" OR "agrifood system*" OR "agri-food system*" OR "sustainable agricultural system*" OR "agroecolog*" OR "agro-ecolog*" OR "sustainable soil management" OR "nutrient management" OR "integrated nutrient management" OR "nutrient cycling" OR "soil health" OR "regenerative agriculture" OR "cover crop*" OR "green manure*" OR "management of landscape elements" OR "tillage management" OR "water management" OR "weed management" OR "crop-soil system*" OR "integrated soil fertility management" OR "crop fertilization management" OR "conservation agriculture" OR "integrated pest and disease management" OR "integrated pest management" OR "agroecological pest management" OR "integrated disease management" OR "crop diversity" OR "crop diversification" OR "crop system diversification" OR "diversified cropping system*" OR "integrated farming system*" OR "mixed farming" OR "mixed cropping" OR "intercropping" OR "diversified farming system*" OR "crop rotation*" OR "agroforestry" OR "polycultures" OR "conservation agriculture" OR "crop-livestock") AND ("food system*" OR "food hub" OR "job creation" OR "employment" OR "income" OR "value chain" OR "knowledge sharing" OR "participatory process*" OR "education" OR "livelihood" OR "extension service*" OR "institutional innovation*" OR "responsible governance" OR "circular economy" OR "culture and food traditi*" OR "human value*" OR "social value*" OR "connectivity" OR "fairness" OR "participation" OR "land governance" OR "resource governance") AND ("vegetable*" OR "legume*" OR "pulses" OR "livestock" OR "cereal*" OR "fruits" OR "tubers" OR "poultry" OR "fish") AND ("South-east Asia" OR "Southeast Asia" OR "Thailand" OR "Cambodia" OR "Laos" OR "Vietnam" OR "Philippines" OR "Indonesia" OR "Myanmar" OR "Burma")

***Search Combination C:* Agroecosystem – Food system – Politico-Economic levels:**

("agrobiodivers*" OR "agro-biodivers*" OR "agrifood system*" OR "agri-food system*" OR "sustainable agricultural system*" OR "agroecolog*" OR "agro-ecolog*" OR "sustainable soil management" OR "nutrient management" OR "integrated nutrient management" OR "nutrient cycling" OR "soil health" OR "regenerative agriculture" OR "cover crop*" OR "green manure*" OR "management of landscape elements" OR "tillage management" OR "water management" OR "weed management" OR "crop-soil system*" OR "integrated soil fertility management" OR "crop fertilization management" OR "conservation agriculture" OR "integrated pest and disease management" OR "integrated pest management" OR "agroecological pest management" OR "integrated disease management" OR "crop diversity" OR "crop diversification" OR "crop system diversification" OR "diversified cropping system*" OR "integrated farming system*" OR "mixed farming" OR "mixed cropping" OR "intercropping" OR "diversified farming system*" OR "crop rotation*" OR "agroforestry" OR "polycultures" OR "conservation agriculture" OR "crop-livestock") AND ("food system*" OR "food hub" OR "safe diet*" OR "healthy diet*" OR "sustainable diet*" OR "dietary diversity" OR "dietary diversification" OR "food security" OR "nutritional security" OR "food access" OR "food biodiversity" OR "job creation" OR "employment" OR "income" OR "value chain" OR "knowledge sharing" OR "participatory process*" OR "education" OR "livelihood" OR "extension service*" OR "institutional innovation*" OR "responsible governance" OR "circular economy" OR "culture and food traditi*" OR "human value*" OR "social value*" OR "connectivity" OR "fairness" OR "participation" OR "land governance" OR "resource governance") AND ("seed polic*" OR "agroforestry polic*" OR "standar*" OR "certification" OR "organic and agroeco* label*" OR "women participation" OR "rural youth employment" OR "school feeding" OR "public procurement program*" OR "market regulation*" OR "subsid* for ecosystem service*" OR "value chain*" OR "global market*" OR "barriers for deployment") AND ("vegetable*" OR "legume*" OR "pulses" OR "livestock" OR "cereal*" OR "fruits" OR "tubers" OR "poultry" OR "fish") AND ("South-east Asia" OR "Southeast Asia" OR "Thailand" OR "Cambodia" OR "Laos" OR "Vietnam" OR "Philippines" OR "Indonesia" OR "Myanmar" OR "Burma")

Annex 3. List of active key stakeholder organizations working on agroecology in Southeast Asia (based on the publications included in the scoping study)

Stakeholder	Country	Stakeholder category
Australian Centre for International Agricultural Research (ACIAR)	Australia	Governmental institution (funding organization)
University of Queensland (UQ)	Australia	Research institution
Australian Agency for International Development (AUSAID) [responsibilities transferred to the Department for Foreign Affairs and Trade in 2014]	Australia	Governmental institution (funding organization)
Eclosio (formerly Aide au Développement Gembloux - ADG)	Belgium	Development organization
Rikolto	Belgium	Development organization
Uni4Coop	Belgium	Development organization
Cambodian Agricultural Research and Development Institute (CARDI)	Cambodia	Research institution
Cambodian Women for Peace and Development (CWPD)	Cambodia	Development organization
Center of Excellence on Sustainable Agricultural Intensification and Nutrition (CE SAIN)	Cambodia	Research institution
Centre for Study and Development in Agriculture (CEDAC)	Cambodia	Development organization
Ministry of Agriculture, Forestry and Fisheries (MAFF)	Cambodia	Governmental institution
Ecosystem Services and Land Use (ECOLAND)	Cambodia	Research institution
Farmer Nature Net (FNN)	Cambodia	Civil society organization
Institute of Technology of Cambodia (ITC)	Cambodia	Research institution
Mondulkiri Indigenous People's Association for Development (MIPAD)	Cambodia	Civil society organization
National University of Battambang	Cambodia	Research institution
Ockenden Cambodia	Cambodia	Development organization
Svay Rieng University (SRU)	Cambodia	Research institution
Royal University of Agriculture (RUA)	Cambodia	Research institution
Vivre de sa terre	Cambodia	Development organization
Danish International Development Agency (DANIDA)	Denmark	Governmental institution (funding organization)
Centre de coopération internationale en recherche agronomique pour le développement (CIRAD)	France	Research institution
French Development Agency (AFD)	France	Development organization (funding organization)
French Facility for Global Environment (FFEM)	France	Development organization (funding organization)
Mediaseeds	France	Development organization
National Research Institute for Development (IRD)	France	Public research body
Professionals for Fair Development (GRET)	France	Development organization
Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH	Germany	Development organization (funding organization)
University of Hohenheim	Germany	Research institution
Boyolali Organic Rice Farmers Association (APPOLI)	Indonesia	Civil society organization
Indonesian Peasant Alliance (API)	Indonesia	Private institution
Alliance of Bioversity and International Center for Tropical Agriculture (CIAT)	Italy	Research institution
Educational and Scientific Services for the University of Florence (PIN)	Italy	Development organization
Terres des Hommes Italia (TdH)	Italy	Development organization
World Agroforestry Center (ICRAF)	Kenya	Research institution
International Livestock Research Institute (ILRI)	Ethiopia	Research institution
Association for Rural Mobilisation and Improvement (ARMI)	Laos	Civil society organization
Community Development and Environment Association (CDEA)	Laos	Development organization

Ministry of Agriculture and Forestry (DALaM)	Laos	Governmental institution
Faculty of Agriculture, National University of Laos	Laos	Research institution
Huam Jai Asasamak Association (HJA)	Laos	Development organization
National Agriculture and Forestry Research Institute of the Ministry of Agriculture and Forestry (NAFRI)	Laos	Public research body
National University of Laos (NUOL)	Laos	Research institution
Sustainable Agriculture and Environment Development Association (SAEDA)	Laos	Development organization
Doh Taung Thu (Our Farmer)	Myanmar	Development organization
Myanmar Institute for Integrated Development (MIID)	Myanmar	Development organization
Myanmar Organic Grower and Producer Association (MOGPA)	Myanmar	Civil society organization
Netherlands Development Organization (SNV)	Netherlands	Development organization
Asian Farmers' Association for Sustainable Rural Development (AFA)	Philippines	Civil society organization
Chalmers University of Technology	Sweden	Research institution
Swedish International Development Cooperation Agency (SIDA)	Sweden	Governmental institution (funding organization)
Stockholm Environment Institute (SEI)	Sweden	Research institution
Centre for Development and Environment (CDE), University of Bern	Switzerland	Research institution
HEKS/EPER	Switzerland	Development organization
Swiss Agency for Development and Cooperation (SDC)	Switzerland	Governmental institution (funding organization)
Swisscontact	Switzerland	Development organization
University of Tasmania (UTAS)	Tasmania	Research institution
Royal King Project Thailand	Thailand	Development organization
Thai Nguyen University of Agriculture and Forestry (TUAF)	Thailand	Research institution
Towards Organic Asia (TOA)	Thailand	Civil society organization
Cornell University	USA	Research institution
Institute for Agriculture and Trade Policy (IATP)	USA	Development organization
Kansas State University (KSU)	USA	Research institution
Agriculture and Forestry Research & Development Center for Mountainous Region (ADC)	Vietnam	Research institution
Center for Agricultural Research and Ecological Studies (CARES)	Vietnam	Research institution
Consultative Institute for Socio-Economic Development of Rural and Mountainous Areas (CISDOMA)	Vietnam	Development organization
Institute for Agricultural Environment (IAE)	Vietnam	Research institution
Institute of Policy and Strategy for Agriculture and Rural Development (IPSARD)	Vietnam	Governmental institution
International Centre for Environmental Management (ICEM)	Vietnam	Private institution
Ministry of Agriculture and Rural Development (MARD)	Vietnam	Governmental institution
National Institute of Animal Sciences (NIAS)	Vietnam	Research institution
Northern Mountainous Agriculture and Forestry Science Institute (NOMAFSI)	Vietnam	Research institution
Research Center for Rural Development (RCRD)	Vietnam	Research institution
Giang University	Vietnam	Research institution
Research centre for Gender, Family and Environment (CGFED)	Vietnam	Research institution
Social Policy Ecology Research Institute (SPERI)	Vietnam	Research institution
Tay Bac University	Vietnam	Research institution
Vietnam Academy of Agricultural Sciences (VAAS)	Vietnam	Governmental institution
Vietnam National University of Agriculture (VNUA)	Vietnam	Research institution
Asia-Pacific Association of Agricultural Research Institutions (APAARI)	Regional	Intergovernmental organization

ECHO Inc.– Asia Regional Impact Center	Regional	Development organization
Mekong Institute	Regional	Intergovernmental organization
Asian Development Bank (ADB)	Multilateral	Private institution
Consultative Group on International Agricultural Research (CGIAR)	Multilateral	Research institution
United Nations Development Programme (UNDP)	Multilateral	United Nations Agency
European Union (EU)	Multilateral	Intergovernmental (funding organization)
Food and Agriculture Organization (FAO)	Multilateral	United Nations Agency (funding organization)
International Fund for Agricultural Development (IFAD)	Multilateral	United Nations Agency (funding organization)
Oxfam International	Multilateral	Development organization

The World Vegetable Center is an international nonprofit institute for vegetable research and development. It mobilizes resources from the public and private sectors to realize the potential of vegetables for healthier lives and more resilient livelihoods.

WorldVeg's globally important genebank, improved varieties, production and postharvest methods help farmers to increase their vegetable harvest, raise incomes in poor rural and urban households, create jobs, and provide healthier, more nutritious diets for families and communities. With headquarters in Taiwan, field operations are led from regional centers in Benin, India, Mali, Tanzania and Thailand, and through offices in other countries.

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