U.PORTO
FACULDADE DE CIÊNCIAS
UNIVERSIDADE DO PORTO

PhD

3rd CYCLE

FCUP
2026

U.PORTO

Agroecology as tool towards food systems transition

Inês Costa Pereira

FC

U.PORTO
FACULDADE DE CIÊNCIAS
UNIVERSIDADE DO PORTO

Agroecology as tool towards food systems transition

Inês de Aragão Pacheco Morais Magro da Costa Pereira
Doctoral Program in Agrarian Sciences
Department of Geosciences, Environment and Spatial Plannings
Faculty of Sciences of the University of Porto
2026

Agroecology as a tool towards food systems transition

Inês de Aragão Pacheco Morais Magro da Costa Pereira
Doctoral Program in Agrarian Sciences
Department of Geosciences, Environment and Spatial Plannings
2026

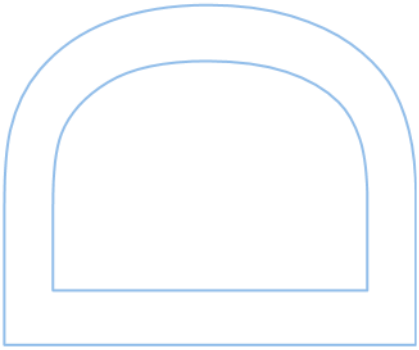
Supervisor
Ana Álvares Ribeiro Marques de Aguiar, Assistant Professor, Faculty of Sciences of the University of Porto

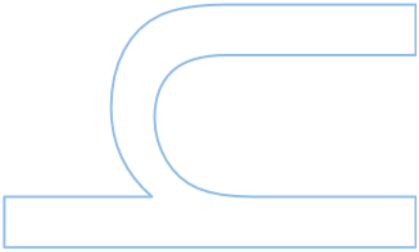
Co-supervisor
Cristina Isabel de Victória Pereira Amaro da Costa, Coordinating Professor, Polytechnic Institute of Viseu
Fernanda Maria Grácio Delgado Ferreira de Sousa, Adjunct Professor, Polytechnic Institute of Castelo Branco

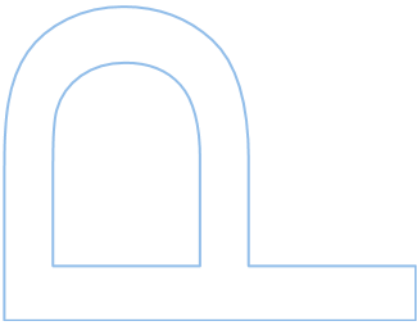
All the corrections determined by the jury, and only those, were made.

The Supervisor,

Porto, _____/_____/_____







Dedicated to Anna do Mar and Keanu

Acknowledgements

Funding for this research was provided by the Portuguese Foundation for Science and Technology (FCT) through an individual doctoral scholarship (ref. UI/BD/153087/2022). I am grateful to FCT for making it possible to undertake this work.

I thank my supervisors, Professors Ana Aguiar, Fernanda Delgado, and Cristina Amaro da Costa, for their guidance throughout this doctoral project, for the time they made available, and for their rigour and constructive feedback. I also thank Professor Cristina Amaro da Costa, in her role as host institution, for believing in my work, for her trust, and for our work in support of the agroecological movement in Portugal. I am grateful for being welcomed into her team, where I found not only colleagues but friendships that I am confident will endure.

I thank all the people and organisations with whom I had the privilege to work in agroecology, through processes of co-construction that brought together food-system actors from production to consumption, civil society, and public institutions. In particular, I thank Caravana AgroEcológica, where I first began working in agroecology, and Alimentar Cidades Sustentáveis for its network-based work, collaboration, and the relationships built along the way. I also thank the collectives that share a commitment to agroecology as a system of principles and relationships, including Al-Bio, GAIA, Terra Sintrópica, and AMAP Porto, for the collaborative work to build a national network for agroecology in Portugal. I am grateful to everyone I met along this path who shared knowledge and experience—from Europe, Latin America, and Africa—contributing to connecting agroecological work across contexts in a shared response to global crises.

I thank the people and initiatives that have shaped my civic engagement, including Rede de Cidadania de Montemor-o-Novo, CampOvivo, GRUCCO, and UCO, for reinforcing my belief in individual agency and the strength of organised communities.

I thank my family for their constant support and patience throughout this process: Rodrigo, for believing in me, even when I did not; Beatriz, Guigo, and Simão, for accepting that my absences had a purpose; my sister Mariana and my cousins Marta and Maria, for their steady presence; and my wider family for continuing to include me despite my frequent absences. And I thank all my friends for their steady and warm presence and encouragement, for believing in me, and for start to believe in agroecology too.

Resumo

Esta tese de doutoramento contribui para a transição agroecológica em Portugal através de uma abordagem integrada que articula (i) a avaliação de práticas e desempenho ao nível da exploração agrícola, (ii) a diversidade de trajetórias na agricultura familiar, ao nível do agricultor e da exploração, e (iii) condições institucionais e territoriais que facilitam ou dificultam a transição. A investigação desenvolve-se em quatro etapas encadeadas e recorre a revisão da literatura sobre metodologias de avaliação agroecológica, trabalho de campo com entrevistas e visitas a explorações, análise documental comparada de instrumentos legislativos e para-legislativos que referem explicitamente a palavra agroecologia e grupos focais para construção participativa de recomendações de políticas públicas. A tese integra quatro artigos correspondentes a estas quatro etapas.

Na primeira etapa, realizou-se uma revisão da literatura (2021) para comparar metodologias de avaliação do desempenho agroecológico ao nível da exploração e desenvolver um instrumento adaptado à agricultura familiar em Portugal, validado por entrevistas presenciais em oito explorações familiares (2022). Os resultados mostram que a avaliação é sensível ao desenho do instrumento: diferentes formas de organizar e agregar indicadores/critérios produzem leituras distintas do desempenho, com implicações para a comparação entre explorações e para uso em políticas. A validação identificou requisitos operacionais para melhorar aplicação e resultados, nomeadamente adaptabilidade territorial e agrícola, explicitação das restrições à transição e linguagem ajustada ao setor.

Na segunda etapa, aplicou-se o instrumento a 40 explorações familiares nas cinco NUTS II do continente português (2023–2024), selecionadas em pares (uma exploração inicialmente considerada agroecológica, por certificação formal/informal, e uma convencional). Os dados foram analisados por estatística exploratória (clustering de Ward e análise multivariada), com 26 indicadores em 10 dimensões: produção vegetal; produção animal; regeneração do solo; regeneração do ciclo da água; gestão de pragas/doenças/infestantes; sinergias ecológicas; sinergias económicas; sinergias sociais; interação com o sistema alimentar local; e partilha de conhecimento agroecológico. Identificaram-se três tipologias de agricultores (convencional, proto-agroecológica e agroecológica), nem sempre coincidentes com a classificação inicial, mostrando que as trajetórias dependem sobretudo das práticas e princípios efetivamente adotados. O perfil agroecológico apresenta desempenho mais próximo

dos princípios agroecológicos e maior expressão em indicadores sociais e económicos; o proto-agroecológico é intermédio; e o convencional menos alinhado.

Na terceira etapa, analisou-se como a transição agroecológica é considerada em políticas públicas e traduzida em instrumentos legislativos e para-legislativos em Portugal, Espanha e França (até julho de 2025), para identificar dimensões priorizadas e tipos de mudança promovidos e informar propostas para Portugal. A análise de conteúdo combinou os níveis de transição de Gliessman com referenciais complementares (11 pilares de Nyéléni, 10 elementos de agroecologia da FAO e 13 princípios do HLPE), com apoio de consulta a atores ligados a entidades de referência. Foram analisados 252 instrumentos (Portugal: 22; Espanha: 165; França: 65), evidenciando concentração em conhecimento e capacitação (44%) e presença residual em soberania/justiça e governança/defesa de recursos naturais (9%), sinalizando lacunas no desenho, implementação e monitorização, em particular em Portugal.

Na quarta etapa, conduziu-se um processo participativo em Tavira, Lisboa e Viseu (três grupos focais; n=29; 2025) para construir recomendações e instrumentos de políticas públicas. Emergiram dois eixos convergentes — educação e literacia alimentar e governança/coordenação multiator — e prioridades territoriais: em Tavira, redes de apoio e medidas ligadas à escassez de água; em Lisboa, prioridades de mercado e acesso a alimentos agroecológicos (benefícios fiscais, contratação pública) e reforço do conhecimento (currículos educativos); em Viseu, experimentação/demonstração ligada a instituições de ensino agrário, conselhos alimentares locais multissetoriais e medidas associadas ao mercado e ao acesso à terra.

No conjunto, a tese mostra que a viabilização da transição agroecológica em Portugal depende de trajetórias diferenciadas entre agricultores e explorações e de condições institucionais e territoriais que assegurem capacidade de aprendizagem, coordenação e implementação, com envolvimento dos diversos atores do sistema alimentar.

Palavras-chave: agricultura familiar; avaliação do desempenho agroecológico; grupos focais; governança territorial; instrumentos de política pública; instrumentos legislativos; tipologias de agricultores; transição agroecológica.

Abstract

This doctoral thesis contributes to the agroecological transition in Portugal through an integrated approach that articulates (i) the assessment of practices and performance at farm level, (ii) the diversity of trajectories within family farming, at both farmer and farm levels, and (iii) institutional and territorial conditions that facilitate or constrain the transition. The research is structured into four sequential stages and combines a literature review on agroecological assessment methodologies, fieldwork based on interviews and farm visits, comparative documentary analysis of legislative and para-legislative instruments explicitly referring the word agroecology, and focus groups for the participatory construction of public policy recommendations. The thesis comprises four articles corresponding to these four stages.

In the first stage, a literature review (2021) was conducted to compare methodologies for assessing agroecological performance at farm level and to develop an assessment tool adapted to the context of family farming in Portugal, validated through face-to-face interviews in eight family farms (2022). The results show that assessment outcomes are sensitive to instrument design: different ways of organising and aggregating indicators/criteria lead to different performance readings, with implications for cross-farm comparison and policy use. Validation identified operational requirements to improve application and results, including territorial and farming-system adaptability, clearer identification of constraints to transition, and the use of sector-appropriate language.

In the second stage, the tool was applied to 40 family farms across the five NUTS II regions of mainland Portugal (2023–2024), selected in paired cases (one farm initially classified as agroecological, based on formal or informal certification, and one conventional farm). Data were analysed using exploratory statistical methods (Ward's clustering and multivariate analysis), based on 26 indicators organised into 10 dimensions: crop production; livestock production; soil regeneration; water cycle regeneration; pest/disease/weed management; ecological synergies; economic synergies; social synergies; interaction with the local food system; and agroecological knowledge sharing. Three farmer typologies were identified (conventional, proto-agroecological and agroecological), not always coinciding with initial classifications, showing that trajectories depend primarily on practices and principles effectively adopted. The agroecological profile shows performance closer to agroecological principles and stronger social and economic indicators; the proto-agroecological profile is intermediate; and the conventional profile is the least aligned.

In the third stage, the way in which the agroecological transition is addressed in public policies and translated into legislative and para-legislative instruments in Portugal, Spain and France (up to July 2025) was analysed, in order to identify prioritised dimensions and types of change promoted and to inform proposals for Portugal. Content analysis combined Gliessman's levels of transition with complementary frameworks (Nyéléni's 11 pillars, FAO's 10 elements of agroecology and the 13 HLPE principles), supported by consultation with actors linked to reference organisations. A total of 252 instruments were analysed (Portugal: 22; Spain: 165; France: 65), revealing a concentration on knowledge and capacity building (44%) and a residual presence of sovereignty/justice and governance/natural resource protection (9%), indicating gaps in policy design, implementation and monitoring, particularly in Portugal.

In the fourth stage, a participatory process was conducted in Tavira, Lisbon and Viseu (three focus groups; n=29; 2025) to develop public policy recommendations and instruments. Two convergent action axes emerged—education and food literacy, and multi-actor governance/coordination—alongside territorially differentiated priorities: in Tavira, support networks and measures addressing water scarcity; in Lisbon, market-related priorities and access to agroecological food (tax incentives, public procurement) and knowledge reinforcement (educational curricula); in Viseu, experimentation/demonstration linked to agricultural education institutions, local multi-sector food councils, and measures related to markets and access to land.

Overall, the thesis shows that enabling the agroecological transition in Portugal depends on recognising differentiated trajectories among farmers and farms, together with institutional and territorial conditions that ensure learning, coordination and implementation capacity, involving diverse actors across the food system.

Keywords: family farming; agroecological performance assessment; focus groups; territorial governance; public policy instruments; legislative instruments; farmer typologies; agroecological transition.

Table of Contents

List of Tables

Article 1

Article 2

Article 3

Article 4

List of Figures

Introduction

Section I

Section II

Article 2

Article 4

Section III

List of Abbreviations

ACT/ATC	Agroecology Criteria Tool
AI and ML	AI and Machine Learning
AML	Lisbon Metropolitan Area
ANOVA	Analysis of Variance
BOE	Spanish Official State Journal
CAP	Common Agricultural Policy
CSA	Community Supporting Agriculture
DRAAF	French Directorate-General for Food, Agriculture and Forestry
ECA	European Court of Auditors
EGALIM Loi	French Law for the Balance of Commercial Relations in the Agricultural and Food Sector and Healthy and Sustainable Food
ENAB	Portuguese National Strategy for Organic Farming
EU	European Union
F-ACT	Farm Level Agroecology Criteria Tool
FAO	Food and Agriculture Organization of the United Nations
FEGA	Spanish Agricultural Guarantee Fund
FranceAgriMer	French National Institute for Agricultural and Marine Products
GIEE	French Economic and Environmental Interest Groups
GPP	Portuguese Department of Planning, Policy and General Administration
HLPE	High Level Panel of Experts
HYVs	High-yielding varieties
IDEA	Indicators of Farm Sustainability
IFAD	International Fund for Agricultural Development

INRAE	French Research Institute for Agriculture, Food and Environment
IoT	Internet of Things
IPCC	Intergovernmental Panel on Climate Change
IPM	Integrated Pest Management
IPES-Food	International Panel of Experts on Sustainable Food Systems
IRS	Income of Individual Persons
LCA-A	Life Cycle Assessment in Agriculture
LEADER	Links between actions for the development of the rural economy programes
MDS	Multidimensional Scaling
MedECC	Mediterranean Experts on Climate and environmental Change
MESMIS	Framework for the Evaluation of Natural Resource Management Systems
MLP	Multi-Level Perspective
NGO	Non-Governmental Organisations
PAEC	Portuguese Circular Economy Action Plan
PCA	Principal Component Analysis
PEPAC	Portuguese Strategic Plan for the Common Agricultural Policy
PNPAS	Portuguese National Programme for the Promotion of Healthy Eating
SAFA	Sustainability Assessment of Food and Agriculture Systems
SO	Specific Objectives
SUD	EU Sustainable Use Directive
RA	Agricultural Census
RISE	Response-Inducing Sustainability Evaluation
RHoMIS	Rural Household Multi-Indicator Survey
RPCG	Rural Pact Coordination Group
SOFI	State of Food Security and Nutrition in the World
TAPE	Tool for Agroecology Performance Evaluation
UN	United Nations
WHO	World Health Organization

Introduction

Over recent decades, food systems have increasingly been described as central to an intertwined environmental, social and economic polycrisis (Ceddia *et al*., 2024). This polycrisis is driven by accelerating climate change (IPCC, 2023), alongside persistent food-security and nutrition challenges (FAO *et al*., 2024). An expanding literature links these pressures to a globalised, corporate-dominated agri-food regime, in which ecological and social objectives are often subordinated to profit imperatives and broader political–economic dynamics (Anderson *et al*., 2019; Rosset & Altieri, 2021; Ceddia *et al*., 2024). Market concentration and corporate influence across agri-food value chains can constrain farmers' agency and autonomy and reinforce structural inequalities, including within policy-making and governance arenas (Anderson *et al*., 2019; Rosset & Altieri, 2021; IPES-Food, 2023; UN, 2025).

These pressures are especially visible in regions where socio-ecological vulnerabilities converge, such as the Mediterranean Basin (Cramer *et al.,* 2018; MedECC, 2020). The region has already warmed by approximately 1.5°C relative to the pre-industrial period and is projected to experience hotter and drier conditions, intensifying drought and water scarcity and increasing risks for agriculture and food systems (Cramer *et al*., 2018; MedECC, 2020). These climate stresses interact with land-use and farming-system changes—particularly agricultural intensification and farmland abandonment—with implications for ecosystem functioning and resilience (Debolini *et al*., 2018; MedECC, 2020).

Against this backdrop of converging crises and growing concentration of corporate power that can undermine the agency and autonomy of farmers and rural communities, agroecology has gained prominence as an approach to reconfiguring food system transition by re-centering food producers' knowledge and rights and strengthening their capacity for community self-organization (Anderson *et al*., 2019; Rosset & Altieri, 2021). However, within policy and institutional arenas, agroecology remains contested and subject to resignification: it is either claimed as a transformative, food-sovereignty approach that confronts structural power relations in corporate-led food systems, or reframed as a narrower set of technical practices compatible with reformist agendas (Giraldo & Rosset, 2017; Rivera-Ferre, 2018; Anderson *et al.,* 2019; Rosset & Altieri, 2021). These competing framings matter because they shape how transitions are designed, funded, and governed, including whether policies strengthen farmers' agency and autonomy or reproduce the conditions that constrain them (Rivera-Ferre, 2018; Anderson *et al*., 2019; UN, 2025).

Agroecology's transformative claims hinge on governance, with transition pathways strengthened through bottom-up, community-led models that enhance producers' agency and autonomy (Anderson *et al*., 2019; Rosset & Altieri, 2021). Family farmers are widely recognised as central to food systems worldwide (FAO & IFAD, 2019) and are particularly important in Mediterranean regions, where small and family farms are acknowledged as key pillars of rural landscapes and ecosystem services, alongside their contribution to food production (MedECC, 2020). In Portugal, family farms represent around 95% of all farms (Dinis, 2025) and are characterised by high pluriactivity, a limited share of full-time agricultural work, and demographic ageing (Dinis, 2019). Limited access to training and technical support has also been identified as a constraint on practice change and agroecological transition (Costa *et al.,* 2022). Despite their relevance, policy and rural-development analyses suggest that family farming remains weakly recognised and only marginally integrated as a central reference in policy design; as a result, farmers' trajectories and constraints are insufficiently reflected in public support measures (Dinis, 2019).

This challenge extends beyond national contexts. Across Mediterranean Europe, the post-2022 CAP and its implementation through national CAP Strategic Plans largely prioritise incremental, efficiency-oriented measures aligned with productivist and capital-intensive models (Hepping *et al*., 2025), despite stated environmental and social ambitions and wider EU rural-policy commitments, including the Commission's long-term Vision for Rural Areas and the associated Rural Pact[1]. In this policy set-up, agroecology is primarily supported as an eligible set of farm-level practices, via "best practice" instruments such as eco-schemes and agri-environment–climate measures, alongside options such as precision farming (Langlais, 2023). Recent audits indicate that these largely voluntary schemes often extend existing green practices and depend on uptake, limiting their capacity to drive deeper structural changes (ECA, 2024).

Furthermore, this framing contrasts with views of agroecology as a systemic transition that requires change beyond the farm level, including broader multi-actor governance shifts and meaningful space for small-scale and family farmers to shape transition pathways (Gascuel-Odoux *et al.,* 2022; Hepping *et al*., 2025). Yet, despite growing recognition of agroecology, research and policy narratives still pay limited attention to how ecological, social and political dimensions interact across farm and territorial scales (Rivera-Ferre, 2018; Anderson *et al.,* 2019; López-García & González de Molina, 2021).

[1] https://ruralpact.rural-vision.europa.eu/index_en

As a result farmers' agency and the plurality of transition pathways are not consistently reflected in research and policy framings, even though operationalising agroecological transitions requires territorial governance arrangements and concrete policy support measures (Anderson *et al*., 2019; López-García & González de Molina, 2021). In Portugal, while family farming is recognised in some policies and measures, it is not consistently treated as a systematic policy reference across government programmes and agricultural planning documents; consequently, farmers' trajectories and constraints risk being only partially reflected in public support measures (Dinis, 2019).

In this thesis, family farms are used as a strategic entry point to examine agroecological transitions through farmers' trajectories, practices and performance, while explicitly situating farm-level change within systemic processes that extend beyond the farm gate to value chains, territorial food systems and governance arrangements, in line with multi-level approaches (López-García & González de Molina, 2021; Rosset & Altieri, 2021; Gascuel-Odoux *et al.,* 2022). Using family farming as an analytical lens enables an integrated assessment of environmental performance, livelihoods, territorial embeddedness and knowledge systems, while recognising that farms are shaped by wider economic, social, environmental and institutional conditions, including policy frameworks. Accordingly, although the empirical focus is on family farmers in Portugal, the thesis contributes to broader debates on how agroecological transitions can be assessed, differentiated and supported through public policy. This is operationalised by linking farm-level assessment, farmer typologies, policy analysis and participatory, policy-oriented co-design within a single analytical framework.

The overall objective of the thesis is to contribute to agroecological transition in Portugal by combining farm-level evaluation of agroecological performance with the co-construction of participatory, context-specific public-policy proposals. To achieve this objective, the thesis follows an integrated analytical pathway that moves from (1) assessing agroecological performance and differentiating farm trajectories, to (2) analysing how policies frame agroecology and which policy levers they privilege or neglect, and (3) co-designing and prioritising feasible policy options with relevant actors. Accordingly, the specific objectives below are not standalone activities: each produces an output that informs the next and, together, they culminate in policy-relevant insights and co-designed, context-specific proposals. The specific objectives (SOs) are as follows:

> **SO1 |** To develop and validate a farm-level methodology to assess agroecological performance in Portuguese family farming, adapting existing tools to local

realities and generating a robust, context-sensitive baseline for technical and policy-relevant assessment.

SO2 | To apply this methodology to a sample of family farms in Portugal to (1) characterise and compare agro-environmental, social and economic performance across farmer typologies and (2) identify motivations, constraints and transition pathways, making heterogeneity visible and informing differentiated policy support.

SO3 | To analyse how agroecology is framed in legislative instruments across Mediterranean countries, combining document analysis and expert consultation, to identify dominant framings and the policy levers they privilege or neglect, and to derive leverage points for typology-sensitive policy design in Portugal.

SO4 | To co-design policy recommendations with key food system actors by eliciting and prioritising enabling conditions, implementation barriers and feasible policy levers for agroecological transition at farm and territorial levels, translating the thesis' empirical findings and policy-framing analysis into context-specific public-policy proposals.

Building directly on the specific objectives, and focusing on identifying policy framings and policy levers, the guiding research question of the thesis is: *Which policy framings and policy levers, when tailored to farm typologies and territorial contexts, are identified as most relevant and feasible to enable agroecological transition in Portugal, using family farms as a strategic entry point?*

To answer this question, the thesis is organised into three main Sections (Figure 1), followed by a final chapter on conclusions and future perspectives.

Section I | Conceptual and theoretical framework establishes the analytical foundations of the thesis, situating agroecology within debates on food system polycrisis, agroecological transition, family farming and the institutionalisation of agroecology in public policy.

Section II | Empirical contributions comprises four articles that, together, address SO1 to SO4, with one article dedicated to each objective: **(1)** *A Methodological Framework for Assessing the Agroecological Performance of Farms in Portugal: Integrating TAPE and ACT Approaches*; **(2)** *Recognizing Diversity to Enable an Agroecological Transition: Understanding the Potential of Family Farmers in Portugal*; **(3)** *Agroecology in Public Policies in Mediterranean Europe: a comparative analysis to inform the Portuguese context*; and **(4)** *Co-*

designing policy levers for place-based agroecological transitions in Portugal. Articles 1 and 2 are published in peer-reviewed journals, while Articles 3 and 4 are currently under review.

Section III | Integrated discussion synthesises findings across the thesis and discusses their implications for public-policy design to enable agroecological transition in Portugal. It also discusses the study's limitations and outlines directions for future research.

The **Conclusion and future perspectives** chapter summarises the main contributions and outlines pathways for collective action towards agroecological food system transitions.

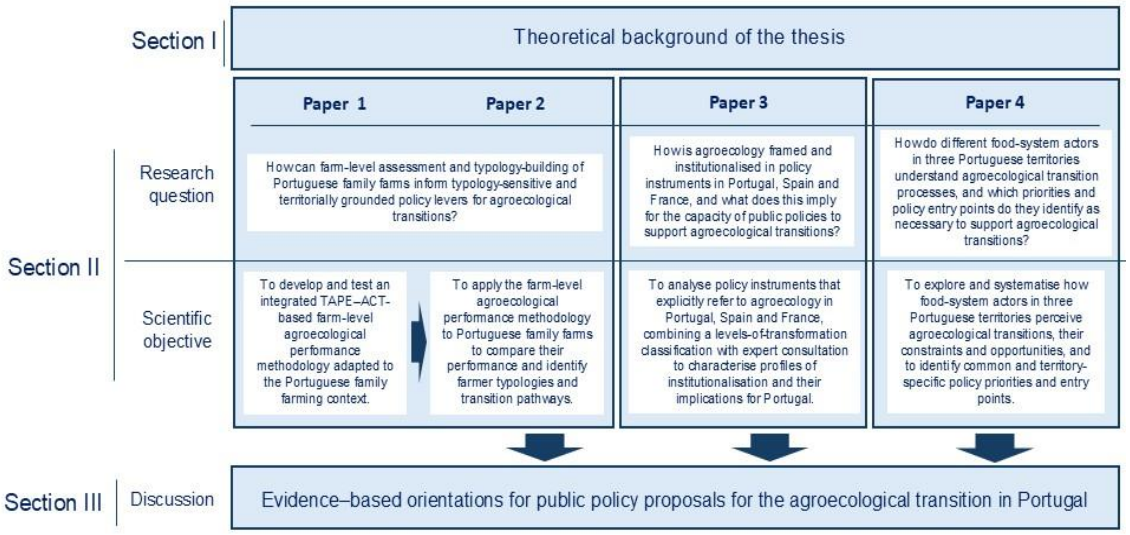


Figure 1 | Structure of the thesis. Section I presents the conceptual and theoretical framework. Section II comprises four article-based chapters (titles shown in the figure), covering farm-level agroecological performance assessment, farmer typologies and transition pathways, comparative policy framings and institutionalisation, and participatory co-design of policy levers. Section III synthesises findings and discusses implications for context-specific public-policy design to enable agroecological transition in Portugal.

Section I
Conceptual Framework

1 | The current state of the global food system

Over recent decades, food systems, (understood as the actors, activities ad outcomes involved in agriculture and aquaculture, processing and manufacturing, retail, consumption and waste, together with the interdependencies, pressures and drivers that connect these domains) have increasingly been portrayed as both shaping and being shaped by interconnected environmental, social and economic crises. These crises are often discussed as a polycrisis, with the potential for cascading systemic risks across sectors (Ceddia *et al.,* 2024; IFAD, 2024; Gambhir *et al*., 2025). From this perspective, food system dynamics interact with politics, health, the environment, society and the economy, shaping how pressures, risks and responses propagate across the system and are mediated through governance arrangements and power relations (Parsons *et al.,* 2019; IPES-Food, 2023; UN, 2025). This food systems perspective is summarised in Figure 1.

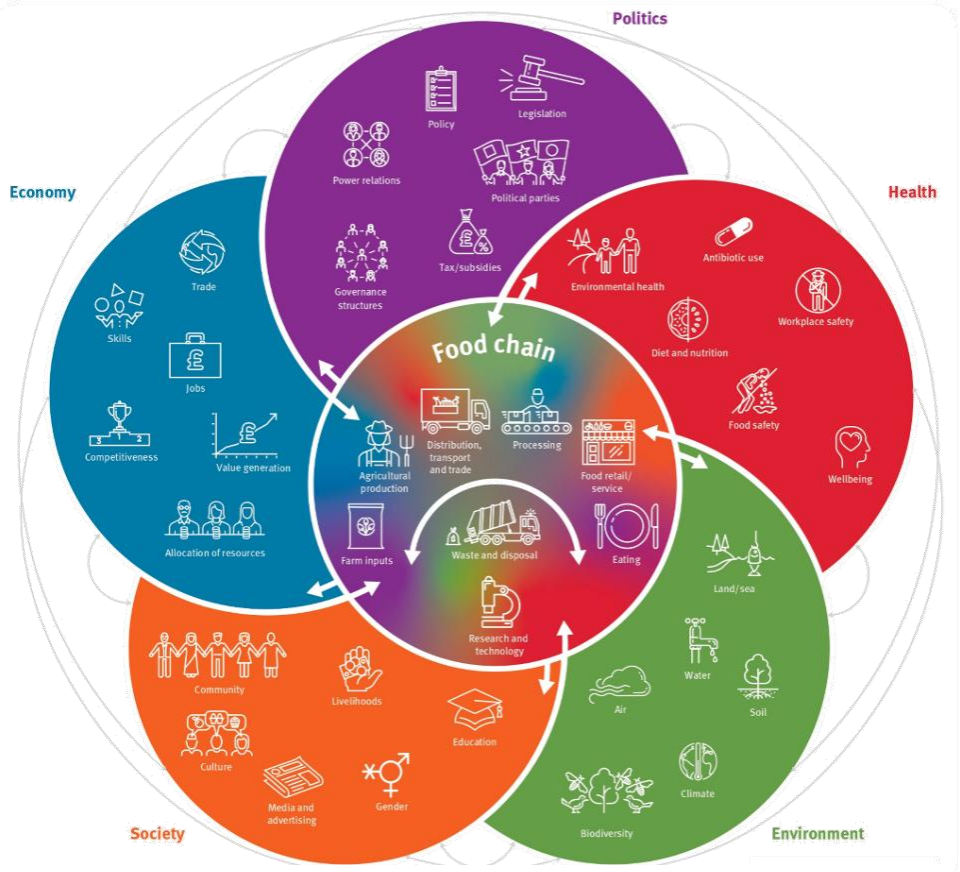


Figure 1 | The food system. Representation of the food system with the food supply chain at its core (agricultural production, processing and manufacture, distribution and retail, eating, and waste and disposal), and its interdependencies with five surrounding domains—politics, health, the environment, society and the economy—which shape and are shaped by food system dynamics. Parsons *et al.* (2019)

Climate change provides a paradigmatic example of such cross-sectoral risk amplification and differential exposure, combining biophysical shifts with uneven social vulnerability: the IPCC estimates that 3.3–3.6 billion people live in contexts that are highly vulnerable to climate change (IPCC, 2023). Globally, food systems are associated with a substantial share of anthropogenic greenhouse-gas emissions (estimated at 21–37%) and major terrestrial biodiversity impacts, driven by land-use change and climate-related pressures (Boakes *et al*., 2024). Biodiversity is a critical foundation for sustainable agriculture, and its erosion undermines ecosystem resilience to climate shocks, as well as to pests and disease outbreaks (IFAD, 2024). Land-use change linked to agricultural expansion and intensive livestock production is also identified as a pathway that increases contact among humans, livestock and wildlife, thereby facilitating infectious-disease emergence, including zoonotic spillover (Rulli *et al*., 2025).

These environmental pressures intersect with persistent nutrition challenges. SOFI 2024 estimates that 713–757 million people faced hunger in 2023 (FAO *et al*., 2024), while the WHO[2] reports that in 2022 around 2.5 billion adults were overweight, including 890 million living with obesity. These outcomes are shaped not only by what food systems produce, but also by how food is processed, distributed and marketed. The UN Special Rapporteur on the right to food notes that the expansion of supermarkets and fast-food chains can displace informal fresh-food markets and increase imports and sales of ultra-processed foods, reshaping diets and reinforcing power asymmetries along food chains (UN, 2025). In parallel, SOFI 2024 shows that access to healthy diets remains constrained by affordability: in 2022, 2.83 billion people could not afford a healthy diet (FAO *et al.,* 2024).

Beyond these biophysical and nutritional outcomes, the polycrisis is also interpreted through a political-economy lens. Research links these dynamics to a globalised, corporate-dominated agri-food regime in which ecological and social goals are often subordinated to profit imperatives and broader political–economic forces that shape food system trajectories (Rosset & Altieri, 2021; Ceddia *et al*., 2024). In this configuration, transnational corporate actors exercise substantial economic and political power, with large multinational firms increasingly controlling key segments of the global food system (from seeds, agrochemical inputs and machinery to processing, distribution and retail) and exerting disproportionate influence over policies, research and markets (Anderson *et al*., 2019; Rosset & Altieri, 2021; Ceddia *et al.,* 2024). Recent syntheses report that four firms control 56% of the global commercial seed market and 61% of the pesticide

[2] https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight

market, illustrating how concentration in upstream sectors shapes farmers' operating conditions (UN, 2025). Concentration is also mirrored in land relations: 1% of large industrial farms control 70% of global farmland, while 84% of farms (under 2 ha) manage only 12%, pointing to structural asymmetries that constrain small-scale and family-farm trajectories (UN, 2025). Market power in input sectors enables significant corporate profits and can constrain farmers' autonomy; in parallel, processes such as land grabbing contribute to displacement and tenure insecurity (Anderson *et al*., 2019; Rosset & Altieri, 2021; Ceddia *et al.,* 2024). From this perspective, climate instability, biodiversity loss and persistent food insecurity can be read as symptoms of structural imbalances within the dominant food regime (Anderson *et al*., 2019; Ceddia *et al*., 2024).

At the same time, food system transitions are frequently framed as a productivity and innovation challenge, in which sustained yield growth, crop improvement and, more recently, digital and precision-agriculture technologies are presented as key pathways to meet future food-security goals (Evans & Lawson, 2020; Gollin *et al.,* 2021; Tzachor *et al.,* 2022; Sharma *et al*., 2023). Evidence from the Green Revolution underpins this framing: high-yielding crop varieties (HYVs) are linked to large yield gains and macro-level development effects (Gollin *et al.,* 2021). Crop-science agendas similarly call for a new "Golden Revolution" focused on raising biomass and yields through gains in photosynthesis and resource-use efficiency, explicitly aiming to meet demand without expanding arable land (Evans & Lawson, 2020). Estimates also suggest that meeting future food demand may require additional agricultural land, depending largely on dietary change and achievable yield gains (Fróna *et al*., 2019). More recent precision-agriculture and digital-twin literatures argue that AI/ML and IoT can enable more targeted input use and real-time decisions, with potential to reduce waste and environmental impacts across production and supply chains (Tzachor *et al*., 2022; Sharma *et al.,* 2023). Critical histories, however, warn that yield-centred technological change can have uneven distributional effects and does not automatically reduce hunger or poverty (Baranski, 2022).

The tension between the promise of productivity- and technology-led solutions (as outlined above) and the persistence of environmental degradation, social conflict and food insecurity points to a deeper epistemic issue: how are problems defined, which knowledge counts, and who gets to decide? Cuenin *et al*. (2019) describe how Green Revolution–style modernization relied on "universal" technological packages and a short-term logic of maximising output and profit through intensive cultivation, monocultures, synthetic fertilisers, irrigation and chemical controls, making farmers increasingly dependent on externally produced inputs. They further argue that this model rests on

reductionist approaches that frame technologies as neutral and keep evaluation and control largely within expert spheres, limiting ethical debate and broader participation in technological choices. Complementary analyses underline how research and innovation systems can reinforce these dynamics through centralized, de-contextualised knowledge production, while corporate influence shapes discourses and policies and narrows democratic scrutiny and participation in decision-making (Anderson *et al.,* 2019; IPES-Food, 2023; UN, 2025).

These interconnected dynamics are especially acute in the Mediterranean Basin, where climate and water stressors intersect with long-standing resource constraints and socio-ecological vulnerabilities, constraining food system resilience and shaping transition possibilities (Cramer *et al*., 2018; MedECC, 2020). The Mediterranean therefore provides a critical context for examining how food system transition pathways are conditioned not only by territorial constraints (notably water scarcity and climate extremes) but also by enabling governance conditions across food system domains beyond agriculture (MedECC, 2020).

2 | The role of agroecology within food system transition

Addressing this interconnected polycrisis requires more than incremental gains in on-farm efficiency or the adoption of isolated farm-level “best practices”: it calls for approaches that can engage simultaneously with ecological degradation, nutrition and health outcomes, and the political–economic conditions that shape how benefits and risks are distributed across food systems (Anderson *et al*., 2019; Ceddia *et al.,* 2024). Accordingly, agroecology, conceptualised by López-García and González de Molina (2021) as the “ecology of the (entire) food system”, is advanced as a transformative approach that combines ecological principles with political and governance dimensions, framing change as a systemic process that extends beyond farm practices to wider food system relations and the social conditions that structure them (Anderson *et al.,* 2019; López-García & González de Molina, 2021; Rosset & Altieri, 2021).

Agroecology, however, is contested rather than neutral: it is mobilised in the literature as a scientific field, a set of ecologically grounded practices, and a social movement, with different emphases across contexts (Rivera-Ferre, 2018; Wezel *et al*., 2018). This plurality makes agroecology vulnerable to being narrowed or strategically reframed as it circulates in policy and market arenas. Rosset and Altieri (2021) argue that agroecology is “at a crossroads”, as it increasingly faces attempts at co-optation that deny its political content and recast it as a narrow set of technical tools compatible with dominant transition agendas. Rivera-Ferre (2018) explains that this vulnerability is amplified when agroecology is treated as fragmented components, she describes an interdependent decision-making system linking assessment (science and knowledge), management (including institutions/governance, social systems and legislation) and practices (related to production, distribution and markets), and argues that separating these elements facilitates the resignification of what “agroecology” comes to mean in policy arenas. Along similar lines, Lamine and Dawson (2018) warn that when agroecology is translated into standards, certification and labelling devices, it can be conventionalised in ways analogous to organic industrialisation; in some contexts, mainstream actors’ efforts to establish production standards may even operate as greenwashing of largely unchanged models.

Against this contested backdrop, López-García and González de Molina (2021) define agroecological transition as medium- to long-term, territorialised processes through

which farming and wider food systems are progressively reconfigured in line with agroecological principles and argue that these transitions must be addressed at a food system scale, not only at farm level. They emphasise that this does not imply a single route but a plurality of transition paths, shaped by context and guided by agroecological values and principles. In parallel, Wezel *et al.* (2020) emphasise that applying agroecological principles can generate diverse pathways ranging from incremental to transformational change, implying reconfiguration not only of practices but also of food system relations "in between" production and consumption, including enabling governance and knowledge dimensions. Consistent with the political stakes highlighted by Rosset & Altieri (2021), these pathways are therefore not "one-size-fits-all" technical shifts, but contested, place-based trajectories whose depth depends on how changes in practices, market relations, knowledge systems and governance arrangements align to sustain agroecology's transformative intent.

At the farm level, agroecological transition is a complex, context-dependent process that goes beyond technical adjustment by prioritising ecological redesign. Grounded in ecological principles and local knowledge, such redesign can enhance soil quality and on-farm biodiversity and strengthen agroecosystem functioning; across diverse contexts, agroecological practices and more complex systems are also associated with stable crop yields and with predominantly positive outcomes for food security and nutrition (Altieri & Nicholls, 2020; Kerr *et al*., 2021). At the same time, transition processes involve changes in social organisation and political agency, shaped by farmers' knowledge systems, market relations and engagement in networks that enable collective learning (Teixeira *et al.*, 2018; Rosset & Altieri, 2021). Because transitions are dynamic and heterogeneous across farms and territories, depending on resources, strategies and institutional environments, analytical approaches need to capture both ecological redesign and the social processes through which transitions unfold over time (Teixeira *et al.,* 2018; Wezel *et al.,* 2020).

Agroecological knowledge co-creation relies on plural knowledge systems and horizontal co-production to generate outputs perceived as credible, salient and legitimate by diverse actors (Cartagena *et al.,* 2025). To keep agroecology's food system scope visible, widely used international frameworks offer a shared language for analysing transition pathways. FAO (2018) articulates agroecology through ten interlinked elements, Diversity; Co-creation and sharing of knowledge; Synergies; Efficiency; Recycling; Resilience; Human and social values; Culture and food traditions; Responsible governance; and Circular and solidarity economy, explicitly combining biophysical, socio-cultural and governance dimensions. The HLPE (2019) consolidates

agroecology into thirteen principles organised around three operational principles for sustainable food systems: improving resource efficiency (Recycling; Input reduction), strengthening resilience (Soil health; Animal health; Biodiversity; Synergy; Economic diversification), and securing social equity/responsibility (Co-creation of knowledge; Social values and diets; Fairness; Connectivity; Land and natural resource governance; Participation). In parallel, the Nyéléni Declaration (IFA, 2015) foregrounds agroecology as an explicitly political and sovereignty - oriented project - centred on territories, commons and collective rights, knowledge pluralism, solidarity-based markets, gender justice and youth, and the need to challenge power structures, emphases that Soto *et al*. (2024) show to be complementary to, but not reducible to, institutional framings. Together, these frameworks provide a shared basis for analysing and assessing agroecological transition in ways that reflect agroecology's ecological, social and political dimensions and align with calls for more consistent approaches to defining and measuring agroecology across scales (Geck *et al.,* 2023).

To make explicit the depth of change implied by different transition pathways, and to clarify what is at stake in processes of resignification, Gliessman (2016) proposes five levels of food system transformation as a useful heuristic. Level 1 focuses on improving the efficiency of industrial and conventional practices to reduce harmful input use; Level 2 on substituting industrial inputs and practices with alternatives; Level 3 on redesigning agroecosystems based on ecological processes; Level 4 on reconnecting producers and consumers through alternative food networks and new relationships; and Level 5 on building a new, sustainable and just global food system. Read alongside the debates above, this framework helps distinguish practice-focused approaches that remain largely within Levels 1–2 from more transformative orientations that extend into redesign, market reconfiguration and governance change (Levels 3–5) (Gliessman, 2016; Rosset & Altieri, 2021). Figure 2 summarises how the HLPE principles, FAO elements and Nyéléni pillars (IFA, 2015) map onto Gliessman's five levels of food system transformation (Gliessman, 2016; Soto *et al.,* 2024)

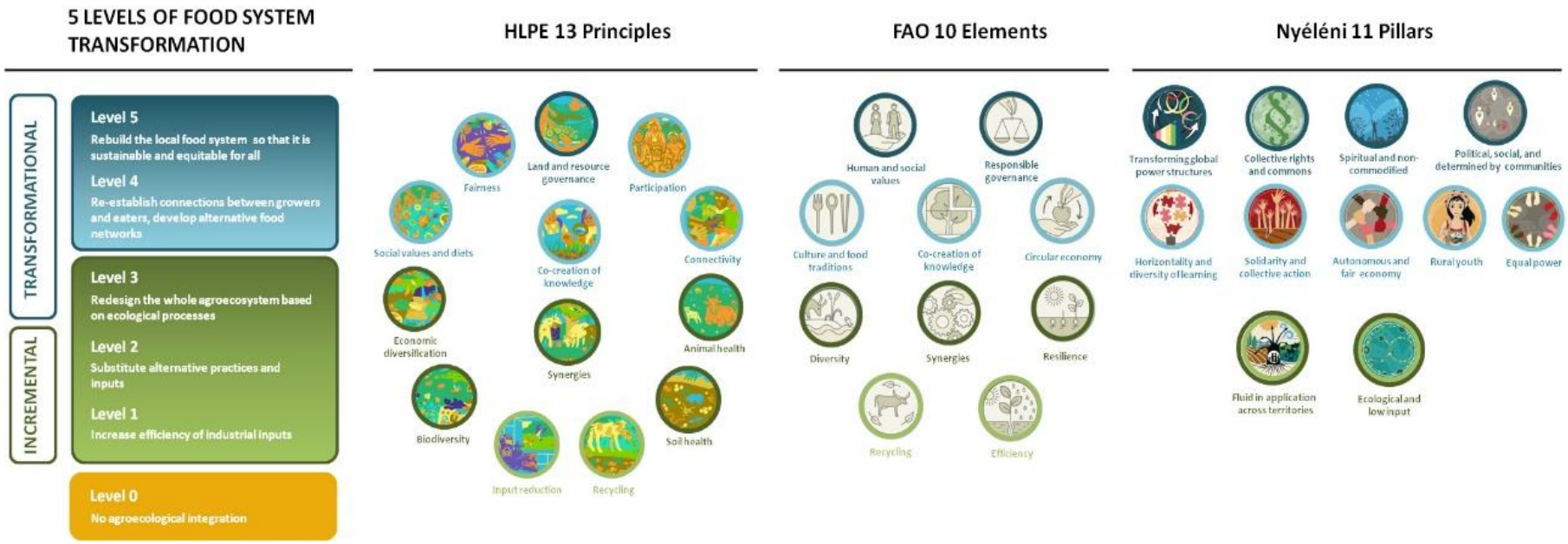


Figure 2 | Mapping of the HLPE 13 Principles, the FAO 10 Elements, and the Nyéléni 11 Pillars (IFA, 2015) onto Gliessman's five levels of food system transformation. The colour coding indicates the level(s) to which each principle/element/pillar is associated (Levels 1–2; Level 3; Level 4; Level 5). Soto *et al.* (2024), drawing on Nyéléni (IFA, 2015), Gliessman (2016), FAO (2018) and HLPE (2019).

These characteristics make assessment and analysis consequential. Sustainability assessment tools can serve multiple functions, including monitoring, policy advice and certification, but their outputs only become meaningful for transition governance when they are used as a basis for discussion, reflection and learning (de Olde *et al*., 2016). At the same time, given divergent definitions, purposes, end-users and contexts, there is no single "best" framework: tool choice necessarily involves trade-offs and should be aligned with the assessment purpose and with the needs of farmers and other stakeholders (de Olde *et al.,* 2016; Bonisoli *et al*., 2018). For agroecology in particular, invoked as a multidimensional approach for food security and nutrition, assessment frameworks therefore need to reconcile local relevance with comparability and accountability across scales, while avoiding the reduction of agroecology to a narrow checklist of practices and making visible governance, autonomy and social-organisation dimensions that remain under-assessed beyond the farm gate (HLPE, 2019; Geck *et al.,* 2023). Overall, these debates and referentials frame assessment as both an analytical and a governance-relevant resource for identifying enabling conditions and leverage points to support agroecological transition pathways (Nyéléni, 2015; FAO, 2018; HLPE, 2019; Rosset & Altieri, 2021). In this thesis, these referentials and debates provide the conceptual basis for analysing agroecological transition in ways that remain faithful to agroecology's systemic scope and that can support policy-relevant discussion of enabling conditions and leverage points (Nyéléni, 2015; FAO, 2018; HLPE, 2019; Rosset & Altieri, 2021).

3 | The role of family farms in agroecological transition

Family farming provides a strong foundation for analysing agroecological transition. Following FAO's working definition, family farming is understood as a way of organising agricultural production that is managed and operated by a family and predominantly reliant on family labour, in which family and farm are linked, co-evolve and combine economic, environmental, social and cultural functions (Garner & de la O Campos, 2014; FAO & IFAD, 2019). Rooted in specific territories and in intergenerational, practice-based knowledge, family farms, particularly in traditional rural regions, can be seen as key sites for maintaining what Toledo & Barrera-Bassols (2009) conceptualise as biocultural memory: a long-term reservoir of locally situated knowledge and experience arising from the co-evolution of human cultures and ecological systems, strongly associated with rural peasant worlds that sustain small-scale, family-based production systems. This territorial embeddedness and multifunctionality resonate with agroecological principles such as diversification, autonomy and co-evolution (López-García, 2020; Costa *et al.,* 2022), making family farms a particularly relevant scale for examining agroecological performance and the diversity of transition pathways.

In Mediterranean contexts, small and family-based farms remain tightly interwoven with rural livelihoods, cultural landscapes and local food provisioning (MedECC, 2020). Yet these roles are increasingly challenged by interacting land-use and climate pressures: trajectories of abandonment in marginal areas and intensification in lowland and coastal zones reshape farming systems and have implications for biodiversity, cultural landscapes and water resources (Debolini *et al.,* 2018; MedECC, 2020). At the same time, nutrition transition dynamics and the growing focus on healthy and sustainable diets are reshaping agri-food priorities and can sharpen trade-offs between competitiveness and ecological sustainability (Antonelli *et al.,* 2022). Together, these dynamics underscore both the vulnerability and the strategic importance of family farming in Mediterranean food system transitions, while reinforcing the need to account for diversity in farms' resources, strategies and transition pathways.

Capturing the role of family farms in agroecological transition requires analytical approaches that make heterogeneity in resources, strategies and contexts visible. Farm typologies offer a structured way to do so by grouping farms (and farmers) into internally coherent types based on selected socio-environmental, structural and individual

characteristics, thereby supporting both systems understanding and the design of differentiated policy instruments (Huber *et al.,* 2024). In transition settings, typologies can also be treated as reference points along a continuum rather than as fixed categories, helping to reveal patterns that inform how transition processes can be assessed and supported (Teixeira *et al.,* 2018). This is particularly relevant for agroecological transition, where principles can be enacted through multiple pathways depending on starting points and local conditions (Wezel *et al*., 2020), and where "one-size-fits-all" technical framings risk obscuring the contested and political dimensions of change (Rosset & Altieri, 2021).

Recent agricultural census-based evidence confirms a continued contraction of Portuguese family farms. Dinis (2025) reports a further decline of around 11% between 2019 and 2023 (-2.9%/year), although family farms still account for about 95% of all holdings. This trend is consistent with the structural dynamics highlighted by GPP (2023) from RA2019, namely the long-term reduction in holdings and agricultural labour. Despite this contraction, family farming remains central to rural economies and to the maintenance of rural landscapes and biodiversity—an importance emphasised both nationally (GPP, 2023) and in global assessments (FAO & IFAD, 2019). Census indicators nonetheless point to persistent constraints, particularly population ageing and gender imbalance: 50.9% of farmers are aged 65+ and women represent 32.7% of farm holders (Dinis, 2025), aligning with the RA2019 profile reported in GPP (2023) (average age 64; 53% aged 65+; women around 33%).

Portuguese evidence highlights structural constraints that shape agroecological transition capacity in family farming. Although family farming accounts for 68% of the agricultural work volume, only 13.1% of farmers rely exclusively on agriculture for their livelihood, and around two thirds devote less than 50% of their working time to the farm (Gomes *et al.,* 2022). Human-capital indicators point to additional limitations: around one fifth of farmers have higher education, while more than half report no formal agricultural training and rely primarily on practical experience for decision-making (Dinis, 2025). Consistent with this, evidence from Portugal and Galicia suggest that education and territorial factors are associated with practice change and underscore the role of training and information networks, including extension-type support, in enabling shifts towards more sustainable practices (Guiné & Costa, 2018). Farm structure may reinforce these constraints, as owner-operated land predominates (80.9% of utilised agricultural area), average farm size is 12.9 ha, and only 15.7% of farmers work full-time on the farm (Dinis, 2025). The author further shows that motivations to continue farming are diverse: around half cite emotional reasons as their main motivation, 33.8% cite supplementary income,

9.0% cite economic viability, and 5.5% cite a lack of professional and income alternatives (Dinis, 2025).

Taken together, these dynamics underline that family farming should be approached not as a residual category but as a strategic component of rural sustainability and agroecological change. Because agroecological transition requires multi-level processes that extend beyond the farm gate, family farms provide an empirical entry point for examining how agroecosystem redesign is negotiated in practice and how it connects to wider food system relations and institutions (López-García & González de Molina, 2021; Rosset & Altieri, 2021; Gascuel-Odoux *et al*., 2022). Yet the consolidation of agroecological transition depends on how farm-level change becomes coupled with collective learning and multi-actor coordination that reorganise local agri-food systems, linking production, distribution and consumption, and that can be territorialised through networks, alliances and locally anchored processes of agroecological dynamization (López-García, 2020; Cartagena *et al.,* 2025). This framing makes explicit that governance arrangements and public policies shape whether such territorial networks can emerge, endure and scale, and thus whether agroecology remains a transformative transition pathway rather than a practice-only adjustment (Rosset & Altieri, 2021; Gascuel-Odoux *et al*., 2022).

4 | Agroecology and public policies for food system transition

Public policies play a central role in shaping agroecological transitions by structuring the incentives, capacities and coordination mechanisms through which agroecological change becomes possible or constrained. Because agroecology is mobilised with multiple meanings, institutionalisation is inherently political. It translates agroecological principles into policy goals, instruments, resources and arenas for decision-making and may involve resignification through competing narratives in the policy arena (Rivera-Ferre, 2018; Wezel *et al.,* 2018). Outcomes therefore depend not only on the design of policy instruments, but also on governance arrangements, actor participation and the broader political economy of food systems. Evidence from Europe suggests that governance networks and participatory planning can strengthen coordination, collective agency and enabling conditions for transition dynamics, whereas fragmented or weakly coordinated policy environments often support agroecology unevenly and channel it into narrow, measure-by-measure implementation (Wezel *et al.,* 2018; Gava *et al.,* 2022, 2025).

In the European Union, the European Green Deal and related strategies frame the sustainability direction of agricultural policy, with implementation largely channelled through the Common Agricultural Policy (CAP) and its national CAP Strategic Plans (ECA, 2024). The extent to which this framework supports incremental adjustment or more substantive change depends on how Member States translate the CAP's "green architecture" into their Plans (ECA, 2024). The European Court of Auditors finds that, although the 2023–2027 Plans are greener than in the previous period, they do not match the EU's climate and environmental ambitions, and eco-schemes and rural development measures often amount to a continuation of existing practices rather than a substantial shift (ECA, 2024) despite wider EU rural-policy commitments (including the long-term Vision for Rural Areas and the Rural Pact). Analyses of the post-2022 CAP debates suggest that more transformative proposals were repeatedly sidelined because discussion and decision-making remained dominated by established insider networks, while fixed interaction routines, ideational deadlocks between competing visions, and technocratic jargon limited the effective influence of newer actors and ideas, thereby reproducing status-quo policy dynamics (Hepping *et al*., 2025). Academic analyses

therefore characterise the reform as privileging incremental, technocratic adjustments and remaining shaped by enduring production-oriented paradigms, while the practical meaning of “transition” is largely determined by Member State–level implementation choices (Barral & Detang-Dessendre, 2023; Langlais, 2023; Hepping *et al.,* 2025).

Within this broader European setting, Mediterranean Europe provides a salient arena for examining how public policies shape agroecological transitions, because accelerated warming and the increasing frequency of heat extremes and drought intensify resource pressures, particularly around water, while farming landscapes are simultaneously being restructured through land abandonment in marginal areas and the intensification and concentration of production in more favourable zones (Cramer *et al.,* 2018; MedECC, 2020). These dynamics unfold in territories where small-scale and family-based farming systems coexist with highly organised and industrialised value chains, and where the abandonment of small-scale farming is associated with losses in socio-economic viability and landscape functions, making policy choices consequential for what kinds of farming and territorial dynamics endure (MedECC, 2020). More broadly, family farming supplies a large share of fresh food for urban consumers, yet its viability hinges on policy mixes that strengthen production conditions while also supporting market channels and collective organisation (e.g., cooperation and access to finance) (Zahaikevitch *et al.,* 2022). This matters for agroecology because scaling transitions beyond the farm entails reorganising local agri-food systems across production, distribution and consumption through plural actors and (often bottom-up) governance arrangements, while also engaging with power struggles over who defines agroecology and how it is translated into public action (López-García & González de Molina, 2021; Rosset & Altieri, 2021).

Despite these shared challenges, agroecology is not interpreted or institutionalised uniformly across European countries, including Mediterranean ones. Cross-country mapping shows Portugal largely framing agroecology as a scientific field, Spain combining scientific and practice-oriented framings, and France placing stronger emphasis on agroecology as a set of practices (Gallardo-López *et al.,* 2018). Policy uptake is similarly uneven and often limited. Agroecology is not backed by a coherent EU-level strategy, and national engagement varies considerably (Wezel *et al*., 2018; Ujj *et al.,* 2025). France stands out for explicitly embedding agroecology in national policy, which has been analysed as an important step in translating agroecological principles into policy objectives and instruments (González *et al.,* 2018; Wezel *et al.,* 2018; Ujj *et al.,* 2025), whereas Portugal illustrates a more nascent institutionalisation with comparatively weaker implementation capacity (Ujj *et al.,* 2025). Given that

agroecological transitions at food system scale depend on governance arrangements, multi-actor coordination and supportive policy frameworks (López-García & González de Molina, 2021), a comparative focus on Portugal, Spain and France helps examine how policy traditions and administrative structures condition what “agroecology” comes to mean in public action and how far it extends beyond practice-level change.

5 | This thesis approach

This thesis is grounded in an epistemological and political stance developed through a four-year immersion in arenas of agroecological transition in Portugal. Over this period, sustained engagement supported the development of relationships with farmers, associations, public institutions and civil-society organisations. In line with participatory and pragmatist perspectives that approach research as “science in action”, combining inquiry with processes of collective learning, reflection and interactive problem-framing. This immersion was treated not only as data collection but also as a mode of inquiry attentive to situated knowledge and public deliberation (López-García, 2020; Magalhães *et al*., 2022). Drawing on agroecology’s emphasis on pluri-epistemic dialogue and reflexive, participatory learning, this engagement also informed the thesis’ participatory orientation and the way it interprets transition and policy processes through relationships, practice and governance dynamics (Darolt *et al*., 2021).

Together, these conceptual elements frame agroecological transition as a contested, multi-level and territorially embedded process in which farm-level redesign, knowledge co-creation and institutional change co-evolve over time. In this thesis, Portuguese family farms constitute the empirical focus and the unit of analysis through which farm-level agroecological performance is assessed and discussed. This farm-based entry point enables the thesis to connect assessment results to the identification of differentiated farmer profiles and, in turn, to the analysis and co-design of policy options to support agroecological transition beyond practice-level change. The framework also treats institutionalisation as a governance process through which agroecology can be enabled, narrowed or resignified, highlighting the relevance of participatory and place-based arrangements for aligning ecological integrity, social justice and territorial objectives. The following sections and articles operationalise this framework by linking farm-level assessment, typologies, comparative policy analysis and participatory co-design to examine how agroecological transition can be supported in practice.

6 | References

Altieri, M. A., & Nicholls, C. I. (2020). Agroecology: Challenges and opportunities for farming in the Anthropocene. *International Journal of Agriculture and Natural Resources, 47*(3), 204–215. https://doi.org/10.7764/ijanr.v47i3.2281

Anderson, C. R., Bruil, J., Chappell, M. J., Kiss, C., & Pimbert, M. P. (2019). From transition to domains of transformation: Getting to sustainable and just food systems through agroecology. *Sustainability, 11*(19), 5272. https://doi.org/10.3390/su11195272

Antonelli, M., Basile, L., Gagliardi, F., & Isernia, P. (2022). The future of the Mediterranean agri-food systems: Trends and perspectives from a Delphi survey. *Land Use Policy, 120*, 106263. https://doi.org/10.1016/j.landusepol.2022.106263

Baranski, M. R. (2022). *The globalization of wheat: A critical history of the Green Revolution*. University of Pittsburgh Press.

Barral, S., & Detang-Dessendre, C. (2023). Reforming the Common Agricultural Policy (2023–2027): Multidisciplinary views. *Review of Agricultural, Food and Environmental Studies, 104*(1), 47–50. https://doi.org/10.1007/s41130-023-00191-9

Boakes, E. H., Dalin, C., Etard, A., & Newbold, T. (2024). Impacts of the global food system on terrestrial biodiversity from land use and climate change. *Nature Communications, 15*, 5750. https://doi.org/10.1038/s41467-024-49999-z

Bonisoli, L., Galdeano-Gómez, E., & Piedra-Muñoz, L. (2018). Deconstructing criteria and assessment tools to build agri-sustainability indicators and support farmers' decision-making process. *Journal of Cleaner Production, 182*, 1080–1094. https://doi.org/10.1016/j.jclepro.2018.02.055

Cartagena, L. B., Hegger, D., Tittonell, P., & Runhaar, H. (2025). How transformative is agroecological knowledge co-creation? Insights from a systematic literature review. *Agroecology and Sustainable Food Systems, 49*(1), 124–150. https://doi.org/10.1080/21683565.2024.2405885

Ceddia, M., Boillat, S., & Jacobi, J. (2024). Transforming food systems through agroecology: Enhancing farmers' autonomy for a safe and just transition. *The Lancet Planetary Health, 8*, e958–e965. https://doi.org/10.1016/S2542-5196(24)00234-1

Costa, C. A., Aguiar, A., Parente, A., Neto, J., Valério, E., Godinho, M. C., & Figueiredo, E. (2022). Innovation in small-farm agriculture in transition toward agroecology among family farmers: Crop protection practices. In A. Rakshit, S. Chakraborty, M. Parihar, V. Meena, P. K. Mishra, & H. B. Singh (Eds.), *Small-farm agriculture* (pp. 139–149). CRC Press. https://doi.org/10.1201/9781003164968-15

Cramer, W., Guiot, J., Fader, M., Garrabou, J., Gattuso, J.-P., Iglesias, A., Lange, M. A., Lionello, P., Llasat, M. C., Paz, S., Peñuelas, J., Snoussi, M., Toreti, A., Tsimplis, M. N., & Xoplaki, E. (2018). Climate change and interconnected risks to sustainable development in the Mediterranean. *Nature Climate Change, 8*(11), 972–980. https://doi.org/10.1038/s41558-018-0299-2

Cuenin, P. H., Botelho, M. I., Santos, D., Oliveira, M., & Cardoso, I. M. (2019). A transição para um sistema agroalimentar mais sustentável: O papel da agroecologia e suas mudanças epistemológicas. *Revista Brasileira de Agroecologia, 14*(2), 22–34. https://doi.org/10.33240/rba.v14i2.22946

Darolt, M., Anglade, J., Moity-Maïzi, P., Lamine, C., Rengard, F., Iceri, V., Genay, A., & Celis, C. (2021). Teaching, training and learning for the agroecological transition: A French-Brazilian perspective. In C. Lamine, D. Magda, M. Rivera-Ferre, & T. Marsden (Eds.), *Agroecological transitions, between determinist and open-ended visions* (EcoPolis, Vol. 37; pp. 153–176). Peter Lang. https://doi.org/10.3726/b19053

de Olde, E. M., Oudshoorn, F. W., Sørensen, C. A., Bokkers, E. A. M., & de Boer, I. J. M. (2016). Assessing sustainability at farm-level: Lessons learned from a comparison of tools in practice. *Ecological Indicators, 66*, 391–404. https://doi.org/10.1016/j.ecolind.2016.01.047

Debolini, M., Marraccini, E., Dubeuf, J.-P., Geijzendorffer, I. R., Guerra, C., Simon, M., Targetti, S., & Napoléone, C. (2018). Land and farming system dynamics and their drivers in the Mediterranean Basin. *Land Use Policy, 75*, 702–710. https://doi.org/10.1016/j.landusepol.2017.07.010

Dinis, I. (2019). The concept of family farming in the Portuguese political discourse. *Social Sciences, 8*(7), 213. https://doi.org/10.3390/socsci8070213

Dinis, I. (2025). Influence of age, gender, and other intrinsic factors on Portuguese family farmers' motivations for short-term continuity. *European Countryside, 17*(1), 70–90. https://doi.org/10.2478/euco-2025-0004

European Court of Auditors (ECA). (2024). *Common Agricultural Policy plans: Greener, but not matching the EU's ambitions for the climate and the environment* (Special Report 20/2024). Publications Office of the European Union. https://www.eca.europa.eu/en/publications/SR-2024-20

Evans, J. R., & Lawson, T. (2020). From green to gold: Agricultural revolution for food security. *Journal of Experimental Botany, 71*(7), 2211–2215. https://doi.org/10.1093/jxb/eraa110

Food and Agriculture Organization of the United Nations (FAO). (2018). *The 10 elements of agroecology: Guiding the transition to sustainable food and agricultural systems*. https://openknowledge.fao.org/handle/20.500.14283/i9037en

Food and Agriculture Organization of the United Nations(FAO), & International Fund for Agricultural Development (IFAD). (2019). *The future of family farming in the context of the 2030 Agenda*. https://openknowledge.fao.org/server/api/core/bitstreams/4a36bac8-a638-4734-b782-4dc57bb3ae28/content

Food and Agriculture Organization of the United Nations (FAO), International Fund for Agricultural Development (IFAD), United Nations Children's Fund (UNICEF), World Food Programme (WFP), & World Health Organization (WHO). (2024). *The state of food security and nutrition in the world 2024: Financing to end hunger, food insecurity and malnutrition in all its forms*. https://doi.org/10.4060/cd1254en

Fróna, D., Szenderák, J., & Harangi-Rákos, M. (2019). The challenge of feeding the world. *Sustainability, 11*(20), 5816. https://doi.org/10.3390/su11205816

Gabinete de Planeamento, Políticas e Administração Geral (GPP). (2023, junho). *Cultivar: Cadernos de análise e prospetiva* (N.º 28; Estruturas agrárias) (pp. 45–102). https://www.gpp.pt/images/GPP/O_que_disponibilizamos/Publicacoes/CULTIVAR_28/

Gallardo-López, F., Hernández-Chontal, M. A., Cisneros-Saguilán, P., & Linares-Gabriel, A. (2018). Development of the concept of agroecology in Europe: A review. *Sustainability, 10*(4), 1210. https://doi.org/10.3390/su10041210

Gambhir, A., Albert, M. J., Doe, S. S. P., Donges, J. F., Farajalla, N., Giatti, L. L., Gundimeda, H., Hendel-Blackford, S., Homer-Dixon, T., Hoyer, D., Adan, S., Jacome-

Polit, D., Kemp, L., Korowicz, D., Kovacic, Z., Kwakkel, J., Laybourn, L., Lempert, R., Mahamoud, A., … Richardson, R. (2025). A systemic risk assessment methodological framework for the global polycrisis. *Nature Communications, 16*, 7382. https://doi.org/10.1038/s41467-025-62029-w

Garner, E., & de la O Campos, A. P. (2014, December). *Identifying the "family farm": An informal discussion of the concepts and definitions* (ESA Working Paper No. 14-10). Food and Agriculture Organization of the United Nations. https://doi.org/10.22004/ag.econ.288978

Gascuel-Odoux, C., Lescourret, F., Dedieu, B., Detang-Dessendre, C., Faverdin, P., Hazard, L., Litrico-Chiarelli, I., Petit, S., Roques, L., Reboud, X., Tixier-Boichard, M., de Vries, H., & Caquet, T. (2022). The Common Agricultural Policy and agroecological transition: Between incremental change and systemic transformation. *Agronomy for Sustainable Development, 42*, 53. https://doi.org/10.1007/s13593-022-00786-4

Gava, O., Povellato, A., Galioto, F., Prazan, J., Schwarz, G., Quero, A. L., Iragui, U. Y., Massa, C. A., Zilans, A., & Carolus, J. (2022). Policy instruments to support agroecological transition in Europe. *EuroChoices, 21*(3), 13–20. https://doi.org/10.1111/1746-692X.12367

Gava, O., Vanni, F., Schwarz, G., Guisepelli, E., Vincent, A., Prazan, J., Rainer-Weisshaidinger, R., Frick, R., Hrabalová, A., Carolus, J., Iragui, Y. U., Pyysiäinen, J., Smyrniotopoulou, A., Vlahos, G., Balázs, K., Szilágyi, A. J., Jegelevičius, G., Mikšytė, E., Zilans, A., Frățilă, M., Röös, E., Miller, M., & Povellato, A. (2025). Governance networks for agroecology transitions in rural Europe. *Journal of Rural Studies, 114*, 103482. https://doi.org/10.1016/j.jrurstud.2024.103482

Geck, M. S., Crossland, M., & Lamanna, C. (2023). Measuring agroecology and its performance: An overview and critical discussion of existing tools and approaches. *Outlook on Agriculture, 52*(3), 349–359. https://doi.org/10.1177/00307270231196309

Giraldo, O., & Rosset, P. (2017). Agroecology as a territory in dispute: Between institutionality and social movements. *Journal of Peasant Studies, 45*(3), 545–564. https://doi.org/10.1080/03066150.2017.1353496

Gliessman, G. (2016). Transforming food systems with agroecology. *Agroecology and Sustainable Food Systems, 40*(3), 187–189. https://doi.org/10.1080/21683565.2015.1130765

Gollin, D., Hansen, C. W., & Wingender, A. M. (2021). Two blades of grass: The impact of the Green Revolution. *Journal of Political Economy, 129*(8), 2344–2384. https://doi.org/10.1086/714444

Gomes, D., Jesus, M., Rosa, R., Bandeira, C., & Costa, C. A. (2022). Women in family farming: Evidence from a qualitative study in two Portuguese inner regions. *Frontiers in Sociology, 7*, 939590. https://doi.org/10.3389/fsoc.2022.939590

González, R. A., Thomas, J., & Chang, M. (2018). Translating agroecology into policy: The case of France and the United Kingdom. *Sustainability, 10*(8), 2930. https://doi.org/10.3390/su10082930

Guiné, R., & Costa, C. A. (2018). Compliance of agricultural practices used in family farms with those recommended in organic farming. *Open Agriculture, 3*, 368–377. https://doi.org/10.1515/opag-2018-0041

Hepping, S., Breeman, G., & Vijver, M. G. (2025). A CAP on ambitions: Power, fragmentation, and the struggle for transformative policy in the post-2022 common

agricultural policy debates. *NJAS: Impact in Agricultural and Life Sciences, 97*(1), 2521262. https://doi.org/10.1080/27685241.2025.2521262

High Level Panel of Experts on Food Security and Nutrition (HLPE). (2019). *Agroecological and other innovative approaches for sustainable agriculture and food systems that enhance food security and nutrition* (Report No. 14). Committee on World Food Security. https://openknowledge.fao.org/server/api/core/bitstreams/ff385e60-0693-40fe-9a6b-79bbef05202c/content

Huber, R., Bartkowski, B., Brown, C., El Benni, N., Feil, J.-H., Grohmann, P., Joormann, I., Mitter, H., & Müller, B. (2024). Farm typologies for understanding farm systems and improving agricultural policy. *Agricultural Systems, 213*, 103800. https://doi.org/10.1016/j.agsy.2023.103800

International Forum for Agroecology (IFA). (2015, February 27). *Declaration of the International Forum for Agroecology, Nyéléni, Mali, 27 February 2015*. http://www.foodsovereignty.org/wp-content/uploads/2015/02/EN-DECLARATION-OF-THE-INTERNATIONAL-FORUM-FOR-AGROECOLOGY-2015.pdf

International Fund for Agricultural Development (IFAD). (2024). *Climate Action Report 2024: Green horizons—A year of climate action for people, resilience and biodiversity*. https://www.ifad.org/en/w/publications/climate-action-report-2024

Intergovernmental Panel on Climate Change (IPCC). (2023). Summary for policymakers. In H. Lee & J. Romero (Eds.), *Climate change 2023: Synthesis report. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* (pp. 1–34). https://doi.org/10.59327/IPCC/AR6-9789291691647.001

Kerr, R. B., Madsen, S., Stüber, M., Liebert, J., Enloe, S., Borghino, N., Parros, P., Mutyambai, D. M., Prudhon, M., & Wezel, A. (2021). Can agroecology improve food security and nutrition? A review. *Global Food Security, 29*, 100540. https://doi.org/10.1016/j.gfs.2021.100540

Lamine, C., & Dawson, J. (2018). The agroecology of food systems: Reconnecting agriculture, food, and the environment. *Agroecology and Sustainable Food Systems, 42*(6), 629–636. https://doi.org/10.1080/21683565.2018.1432517

Langlais, A. (2023). The new Common Agricultural Policy: Reflecting an agroecological transition. *Review of Agricultural, Food and Environmental Studies, 104*(1), 51–66. https://doi.org/10.1007/s41130-022-00183-1

López-García, D. (2020). Who is the subject of agroecological transition? Local agroecological dynamisation and the plural subject of food systems transformation. *Landbauforschung: Journal of Sustainable and Organic Agricultural Systems, 70*(2), 36–42. https://doi.org/10.3220/LBF1606213050000

López-García, D., & González de Molina, M. (2021). An operational approach to agroecology-based local agri-food systems. *Sustainability, 13*(15), 8443. https://doi.org/10.3390/su13158443

Magalhães, T., Andion, C., & Manoel, A. A. (2022). Collaborative research, public inquiry, and democratic experimentalism: Contributions and how to apply pragmatism to social innovation studies. *Canadian Journal of Nonprofit and Social Economy Research, 13*(S1), 71–91. https://doi.org/10.29173/cjnser543

Mediterranean Experts on Climate and Environmental Change (MedECC). (2020). *Climate and environmental change in the Mediterranean Basin: Current situation and*

risks for the future (First Mediterranean Assessment Report). Union for the Mediterranean; Plan Bleu; UNEP/MAP. https://doi.org/10.5281/zenodo.4768833

Parsons, K., Hawkes, C., & Wells, R. (2019). *Brief 2: Understanding the food system: Why it matters for food policy* (Rethinking Food Policy series). Centre for Food Policy, City, University of London. https://www.citystgeorges.ac.uk/__data/assets/pdf_file/0004/570442/7643_Brief-2_What-is-the-food system-A-food-policy-perspective_WEB_SP.pdf

Rivera-Ferre, M. G. (2018). The resignification process of agroecology: Competing narratives from governments, civil society and intergovernmental organizations. *Agroecology and Sustainable Food Systems, 42*(6), 666–685. https://doi.org/10.1080/21683565.2018.1437498

Rosset, P. M., & Altieri, M. A. (2017). *Agroecology: Science and politics*. Practical Action Publishing. https://doi.org/10.3362/9781780449944

Rulli, M. C., D'Odorico, P., Galli, N., John, R. S., Muylaert, R. L., Santini, M., & Hayman, D. T. S. (2025). Land use change and infectious disease emergence. *Reviews of Geophysics, 63*(2), e2022RG000785. https://doi.org/10.1029/2022RG000785

Sharma, A., Tselykh, A., Bozhenyuk, A., Choudhury, T., Alomar, M. A., & Sánchez-Chero, M. (2023). Artificial intelligence and internet of things oriented sustainable precision farming: Towards modern agriculture. *Open Life Sciences, 18*(1), 20220713. https://doi.org/10.1515/biol-2022-0713

Soto, R. L., Oteros-Rozas, E., & Rivera-Ferre, M. (2024). Coexisting definitions of agroecology in Europe: Specificities and complementarities to scale agroecology up. In S. G. Florença, R. P. F. Guiné, C. A. Costa, M. Machado, S. Santos, & I. Costa-Pereira (Eds.), *X Congresso Internacional de Agroecologia—Livro de atas: Agroecologias do mundo: unidas para enfrentar as crises globais* (pp. 561–567). Instituto Politécnico de Viseu & CERNAS-IPV. https://bibliotecadigital.ipb.pt/bitstreams/94d28a70-c6d6-4153-85b4-f7b1c0d213af/download

Teixeira, H. M., Van den Berg, L., Cardoso, I. M., Vermue, A. J., Bianchi, F. J. J. A., Peña-Claros, M., & Tittonell, P. (2018). Understanding farm diversity to promote agroecological transition. *Sustainability, 10*(12), 4337. https://doi.org/10.3390/su10124337

Toledo, V. M., & Barrera-Bassols, N. (2009). *La memoria biocultural: La importancia ecológica de las sabidurías tradicionales*. Icaria Editorial. https://www.uv.mx/orizaba/mgas/files/2016/03/memoria-biocultural.pdf

Tzachor, A., Richards, C. E., & Jeen, S. (2022). Transforming agrifood production systems and supply chains with digital twins. *npj Science of Food, 6*, 47. https://doi.org/10.1038/s41538-022-00162-2

Ujj, A., Nagyné Pércsi, K., Ramos-Díaz, F., Budimir-Marjanović, J., Horstink, L., Queiroga-Bento, R., Mukosha, C. E., Moudrý, J., Diána, K. G., & Jancsovszka, P. (2025). Agroecological adoption pathways in Europe: Drivers, barriers, and policy implication opportunities in the Czech Republic, Hungary, and Portugal. *Agriculture, 15*(23), 2414. https://doi.org/10.3390/agriculture15232414

United Nations. Human Rights Council (UNHRC). (2025, January 2). *The right to food, finance and national action plans: Report of the Special Rapporteur on the right to food, Michael Fakhri* (A/HRC/58/48). https://docs.un.org/en/A/HRC/58/48

Wezel, A., Goette, J., Lagneaux, E., Passuello, G., Reisman, E., Rodier, C., & Turpin, G. (2018). Agroecology in Europe: Research, education, collective action networks, and

alternative food systems. *Sustainability, 10*(4), 1214. https://doi.org/10.3390/su10041214

Wezel, A., Herren, B. G., Kerr, R. B., Barrios, E., Gonçalves, A. L. R., & Sinclair, F. (2020). Agroecological principles and elements and their implications for transitioning to sustainable food systems: A review. *Agronomy for Sustainable Development, 40*, 40. https://doi.org/10.1007/s13593-020-00646-z

Zahaikevitch, E. V., Medina Macedo, L., Telles, L. B., Bittencourt, J. V. M., & Zahaikevitch, A. G. V. (2022). Contemporary public policies to strengthen family farming in the international perspective: A bibliometric study. *Journal of Open Innovation: Technology, Market, and Complexity, 8*(1), 8. https://doi.org/10.3390/joitmc8010008

Section II
Empirical contributions

Article 1 | A methodological framework for assessing the agroecological performance of farms in Portugal: Integrating TAPE and ACT approaches

Costa-Pereira, I., Aguiar, A. A. R. M., Delgado, F., & Costa, C. A. (2024). A methodological framework for assessing the agroecological performance of farms in Portugal: Integrating TAPE and ACT approaches. *Sustainability*, 16(10), 3955. https://doi.org/10.3390/su16103955

Paper available online on May 8, 2024

Classification according to journal: research paper

Bibliometric indicators from Web of Science

Journal Impact Factor | 3.3

Ranking | 58%

Quartile | Q2

ANNEX 1 | Questionnaire administered to family farmers and the TAPE indicator matrix

sustainability

MDPI

Article

A Methodological Framework for Assessing the Agroecological Performance of Farms in Portugal: Integrating TAPE and ACT Approaches

Inês Costa-Pereira [1,2,*], Ana A. R. M. Aguiar [3], Fernanda Delgado [4,5] and Cristina A. Costa [1,2]

[1] IPV-ESA-Polytechnic Institute of Viseu, Agrarian School, Quinta da Alagoa Estrada de Nelas, 3500-606 Viseu, Portugal; amarocosta@esav.ipv.pt
[2] CERNAS-IPV-Centre for Natural Resources, Environment and Society, Polytechnic Institute of Viseu, Polytechnic Campus, 3504-510 Viseu, Portugal
[3] GreenUPorto—Sustainable Agrifood Production Research Centre/Inov4Agro, DGAOT, Faculty of Sciences, Campus de Vairão, University of Porto, Rua da Agrária 747, 4485-646 Vairão, Portugal; aaguiar@fc.up.pt
[4] IPCB-ESA-Polytechnic Institute of Castelo Branco, Agrarian School, Quinta da Senhora de Mércules, Apartado 119, 6001-909 Castelo Branco, Portugal; fdelgado@ipcb.pt
[5] CERNAS-IPCB-Research Centre for Natural Resources, Environment and Society, Polytechnic Institute of Castelo Branco, 6001-909 Castelo Branco, Portugal
* Correspondence: inespereira@esav.ipv.pt

Abstract: Agroecology integrates science, social movements, and agricultural practices, playing a central role in the sustainability of food systems. It addresses agroecosystems and food systems holistically; however, defining whether a farm is agroecological remains a challenge. This article proposes a methodology to measure farms' agroecological performance, adapted to the family farming context in Portugal. The aim of the developed methodology is to compare the agroecological performance of family farms (conventional and non-conventional), providing information about anchors for agroecological transition and supporting public policies. A literature review identified existing farm evaluation methodologies, with Tool for Agroecological Performance Evaluation (TAPE) and Agroecology Criteria Tool (ACT) scoring highest in an assessment process. Questions from both were integrated into a questionnaire for family farmers. This field work provided critical insights towards the methodologies: (1) territorial adaptability; (2) transition constraints' origin; and (3) use of non-academic language. The results were incorporated into the developed methodology, which combines the TAPE indicator matrix and Gliessman's five levels of food system change, the latter of which provides the framework for the ACT. This study made it possible to identify the most relevant aspects for characterizing family farmers/farms and the importance of how the evaluation criteria/indicators are ordered by element/theme, as it alters the values of each farm's agroecological performance.

Keywords: agroecology transition; family farms; territorial approaches; indicators for transition

Citation: Costa-Pereira, I.; Aguiar, A.A.R.M.; Delgado, F.; Costa, C.A. A Methodological Framework for Assessing the Agroecological Performance of Farms in Portugal: Integrating TAPE and ACT Approaches. *Sustainability* **2024**, *16*, 3955. https://doi.org/10.3390/su16103955

Academic Editor: Francesco Sottile

Received: 28 February 2024
Revised: 2 May 2024
Accepted: 4 May 2024
Published: 9 May 2024

1. Introduction

The impacts of conventional agriculture systems are recognized at the environmental level (biodiversity loss, water pollution, and scarcity of natural resources) [1–6], human health level (rates of malnutrition and hunger and intoxication of farmers and consumers) [7–10], and the level of rural territories (inadequate payments to farmers and rural abandonment) [11–13]. As an alternative path, agroecology has gained importance in regard to food systems' sustainability, and its approaches have come to prominence in technical, scientific, and political discourses [14–16]. However, agroecology must be supported by public policy that is co-constructed and adapted to each territory as a tool for the transition to more sustainable food systems [17,18].

Agroecology merges sustainable agricultural practices, social movements, and science; and it is more effective when these three dimensions converge [19,20]. The concept of agroecology is dynamic, holistic, and should be applied to the food system, from production to consumption, by integrating action and change aimed towards economic, ecological, and social sustainability. As a social movement, agroecology focuses on creating local food systems that support rural communities' sustainability by promoting safe food production practices, short food supply chains, and food sovereignty. As a set of agricultural practices, agroecology aims to improve agricultural systems based on natural processes, enhancing interactions and strengthening beneficial synergies between the components of the agroecosystem, using ecological processes and ecosystem services as tools, and reducing dependence on off-farm inputs. As a science, agroecology integrates research, education, action, and change [21,22].

Most agroecological farmers are smallholders and/or family farmers that use traditional and environmentally friendly farming techniques/technologies, such as crop selection and rotation, intercropping, agroforestry, or mulching. They use inputs produced on the farm, and they do not use synthetic fertilizers or pesticides favoring organic fertilization and biological pest control, among other practices. Frequently, agroecological farmers use innovative practices as reduced tillage, drip irrigation, or direct seeding [22,23]. These farmers frequently connect through social networks for the co-creation and exchange of agroecological knowledge and are involved in local food systems [16,22].

For the purpose of this study, we analyzed family farms, as they represent, in Portugal, more than 90% of the country's single farmers [24]. FAO & IFAD [25] defined family farms as those managed and operated by a family that lives ond the farm and provide the majority of the farm labor. Moreover, family farming is recognized as going beyond the productive or economic perspective of modern and intensive agriculture because it preserves and transmits local knowledge, protects the natural resources, and ensures food security for the families [26].

Recent studies, carried out in the north and center of Portugal, reveal that family farms maintain a majority of sustainable practices. However, to sustain the agroecological transition, it is necessary to identify and overcome compromising practices that are detrimental to public and environmental health—e.g., the use of synthetic pesticides and fertilizers [16,27–30]. To support this transition, it is necessary to assess the family farms' agroecological performance, identifying factors that: (1) can anchor that transition; (2) raise the farmers' willingness to start the transition process; and (3) advocate for public policies that promote the agroecological transition on Portuguese farms.

Although there are several methodologies to evaluate the farms' agroecological performance or the farms' sustainability, their limitations have been identified. The research done by authors such as Widget [31], de Olde [32], Bonisoli [33], or Nicholls [34] state that these methodologies are usually designed to be applied only to a geographical region and/or are based on indicators unable to capture the multifunctionality of the agroecosystem (e.g., economic function or food-production indicators).

Thus, to support the design of public policies that promote the family farms' agroecological transition in Portugal, a defined methodology is needed to analyze agricultural systems with regard to their territorial context, their role in rural territories, and their pivotal connection with urban territories. It is also necessary to emphasize that, although addressed at a local/national level, the important role of family farming and its lack of support is a global problem that needs to be addressed collectively to give it visibility and strength. This study presents a methodology designed to be used in farms (also) in European contexts, one focused on assessing their agroecological performance by providing information on the anchors for the agroecological transition—the baseline information for the development of co-constructed guidelines for adequate public policies for the agroecological transition.

2. Materials and Methods

To develop the farms agroecological-performance methodology, a systematic literature review was conducted between September and December 2021 using the web platforms and databases Scopus, Web of Science, and Google Scholar. Several combinations of keywords were used, including "agroecology", "agroecological", "sustainable", "transition", "assessment", "tool", and "method", connected with the boolean operators "AND" and "OR". This thorough search turned up 12 different combinations.

The main objective of the literature review was to identify the most cited and recognized methodologies for the evaluation of the farms' agroecological or sustainability performance. A total of 123 records were identified from the referred databases and 27 were selected, based on inclusion and exclusion criteria. The inclusion criteria were: English-language, original articles, published since 2010, focused on methodologies for the evaluation of the agroecological or sustainability performance of farms, and the evaluation of those methodologies. The exclusion criteria were: grey literature on the topics, original articles off topic, and full-texts not available. Of the 27 scientific articles selected, 10 methodologies were compiled: Agroecology Criteria Tool (ACT) and Farm Level Agroecology Criteria Tool (F-ACT), the Indicateurs de Durabilité des Exploitations Agricoles (IDEA), Life Cycle Assessment in Agriculture (LCA-A), Marco para la Evaluacion de los Sistemas de Manejo de Recursos Naturales (MESMIS), Multi-Level Perspective (MLP), Response-Inducing Sustainability Evaluation (RISE), Rural Household Multi-Indicator Survey (RHoMIS), Tool for Agroecology Performance Evaluation (TAPE), and Sustainability Assessment of Food and Agriculture Systems (SAFA).

To analyze the 10 selected methodologies, a procedure for their evaluation was developed based on the studies carried out by Binder [35], de Olde [32], Talukder & Blay-Palmer [36], and Bonisoli [33], related to their normative dimension (focused on the methodology evaluation) and procedural dimension (focused on how the assessment was carried out). The criteria selected were those that best responded to the objective and purpose of the methodology to be developed. For the normative dimension, the goal-setting approach; for the procedural dimension, the methodology simplicity, time requirement, assessment purpose, indicators and attributes, target group, stakeholders' participation, geographical application, and assessment level; as shown in Table 1.

The evaluation of the 10 selected methodologies, using the normative and procedural dimensions, consisted of assigning a value of 0 (zero) when the criteria was absent and 1 (one) when it was present. The methodologies with the highest scores were those with the presence of most of the criteria selected. The results of the methodologies' evaluation are presented in Table 2, were each column sums the results obtained from each criterion (e.g., for the criteria "methodology simplicity", ACT scored 1 in "graphic visualization of the results", "free access to software", "easy access to software", and "free access to tutorials" resulting in a total score of 4). The methodologies with the highest scores (TAPE and ACT) were the ones selected for the next step.

Table 1. Methodology analyses framework with the dimensions, criteria valuations, and justifications.

Dimension	Criteria Valuation: Yes (1)/No (0)	Criteria Justification	References
Normative Dimension: scope of the methodology evaluation	Goal setting approach: bottom-up (stakeholder); top-down (theory)	The definition of the methodology goals provides the basis of and operationalizes the farms assessment. It is important to understand whether the methodology goals and criteria are: (a) predefined and theoretical, derived from a definition of agroecology/sustainability (top-down approach); (b) defined by stakeholders in a participatory process (bottom-up approach). The combination of top-down and bottom-up approaches was assumed to be a transdisciplinary approach	[33,35]

Table 1. *Cont.*

Dimension	Criteria Valuation: Yes (1)/No (0)	Criteria Justification	References
Procedural Dimension: how the assessment was carried out	Methodology simplicity: graphic visualization; free access; easy to access; free access to the tutorials	The methodology simplicity, or its user friendliness, was assessed based on: (a) graphic visualization of the results that simplifies the end users' (farmers and policy makers) understanding; (b) access to free methodology software that allows a fast and automatic calculation of the results and improves the communication between users; (c) in some cases, the methodologies are available for free, but it is necessary that some procedures are accessible; (d) free access to tutorials to help the simplify the methodology's application.	[36]
	Time requirement: more than 5 h; between 3 and 5 h; less than 3 h	The time required for the methodology application is directly connected to the effort needed to get to know and apply the methodology and discuss the results. If a methodology is too time consuming, that it can be an inhibiting factor for its success.	[32]
	Assessment purpose: self-assessment and guidance; assessment and guidance; multiple purpose	Refers to the aim for which the tool was created, which can be for: (1) self-assessment and guidance: intended to be used by farmers themselves; (2) assessment and guidance: developed with the purpose of helping farmers assess and pursue sustainability/agroecology in their farms; (3) multiple purpose: designed for multiple stakeholders or developed with multiple purposes, without a specific sustainability/agroecology target.	[35]
	Indicators' attributes: predetermined; specific criteria; selection presented; interaction:	The availability of information about the indicators, including whether they are predefined, why they were selected, and whether there is an interaction between indicators, allows for assessing the robustness of the methodology and guarantees its replicability.	[33,35]
	Indicators' reference values: target values; threshold values; relative values	Reference values might be defined to assess the level of sustainability for a set of indicators. They can be absolute (target value or threshold) or relative: (1) target values: identify a desirable condition; (2) threshold values: define a minimum and maximum acceptable level; (3) relative values: compare indicators with an initial value, regional or sample average, or desirable trend.	[32,36]
	Target group: farmers; policy makers; researchers; educators	Target groups can range from farmers to educators. It is important to know the target group(s) of the methodology, and to understand if key elements for the analysis may be missing.	[35]
	Stakeholders' level of participation: whole process; partial; none	There are different degrees of stakeholder involvement in the methodology's application: (1) stakeholders can play a central role in the development, application, and interpretation of the indicators; (2) stakeholders can be consulted in specific parts of the methodology (development, application, or interpretation); (3) or their participation is not taken into account.	[35]
	Application in: Global North; Global South	Some methodologies were developed for specific socio-geographic contexts and are not suitable for replication in different socio-geographic contexts (e.g., developed and underdeveloped countries)	[32]

Based on the content of the selected methodologies (TAPE and ACT), a set of questions was integrated in the questionnaire applied to family farmers. This questionnaire was organized to respond the TAPE Grid of Indicators (Step1) and Evaluation Criteria (Step 2)

and to the ACT questions, aiming to verify the suitability of these methodologies to assess Portuguese family farmers' agroecological performance.

TAPE was created by the Food and Agriculture Organization (FAO) to evaluate different production systems, including forestry, aquaculture, fisheries, and agricultural production, adaptable to different cultural and context circumstances. Four steps make up the TAPE process. STEP 0: gather relevant data on the area of study, important for step 3. STEP 1: evaluation, through the application of a questionnaire to farmers and a grid of 35 indicators, of the FAO's 10 elements of agroecology: recycling, efficiency, diversity, resilience, synergies, co-creation and sharing of knowledge, cultural and food traditions, human and social values, circular and solidarity economy, and responsible governance. The grid of indicators assessment is based on descriptive scales for evaluation ranging from 0 (indicative of lower agroecological performance) to 4 (indicative of higher agroecological performance). STEP 2: analysis of the 10 Evaluation Criteria: agrobiodiversity, soil health, production, income, added value, exposure to pesticides, dietary diversity, women's empowerment, youth job opportunities, and land tenure. These criteria are categorized into three levels: desirable, acceptable, and undesirable. STEP 3: participatory analysis of the results together with the farmers.

The ACT was developed by the Foundation for Ecological Development (Biovision). It is rooted in Gliessman's [37] categorization of the five levels representing the transition of food systems. These levels involve (1) enhancing the efficiency of conventional and industrial practices, (2) substituting conventional or industrial inputs with more sustainable alternatives, (3) redesigning entire agroecosystems, (4) reestablishing connections between growers and consumers through the development of alternative food networks, and ultimately, (5) restructuring the global food system to ensure sustainability and equity for all. These levels are aligned with eleven elements: regulation and balance, plus FAO's 10 elements of agroecology. The transition criteria defined (62 in total), can be answered with a 0 (if absent) or a 1 (if present). The resulting evaluations can be presented individually or collectively for a range of farms.

The questionnaire was applied, in a face-to-face interview, to eight family farmers between April and August 2022 in the Centre (Fundão, Mangualde, Viseu, and Vouzela municipalities) and South (Arraiolos and Évora municipalities) of Portugal (Figure 1). The contact with the family farmers was done through partnerships with local development organizations and farmers' associations.

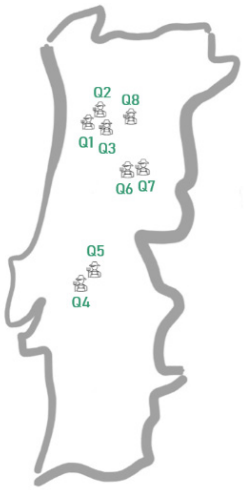


Figure 1. Localization of the farms (Q1–Q8) where the selected methodologies were applied.

3. Results

In the evaluation of the normative and procedural dimensions of the 10 selected methodologies for the evaluation of the farms' agroecological or sustainability performance, the highest score was 18 points, achieved by both TAPE and ACT (Table 2).

Table 2. Analysis of the 10 methodologies for farms' sustainability/agroecology assessment. Valuation criteria were scored as Yes (1)/No (0). Each cell presents the result obtained on each criterion (e.g., on the criterion "methodology simplicity", ACT scored 1 in "graphic visualization of the results", "free access to software", "easy access to software", and "free access to tutorials", making its score 4 in total).

	Normative Dimension	Procedural Dimension										
Methodology	**Goal Setting Approach: Bottom-Up (Stakeholder) OR Top-Down (Theory)**	**Methodology Simplicity: Graphic Visualization of the Results AND/OR Free Access to the Software AND/OR Easy to Access the Software AND/OR Free Access to the Tutorials**	**Time Requirement: More than 5 h OR between 3 and 5 h OR Less than 3 h**	**Assessment Purpose: Self-Assessment and Guidance OR Assessment and Guidance OR Multiple Purpose**	**Indicators' Reference Values: Target Values AND/OR Threshold Values AND/OR Relative Values**	**Indicators' Attributes: Predetermined Indicators AND/OR Specific Criteria for the Indicators' Selection Presented AND/OR Indicators' Interaction**	**End Users: Farmers AND/OR Policy Makers AND/OR Researchers AND/OR Educators**	**Stakeholders' Level of Participation: Whole Process OR Partial OR None**	**Applied on: Global North AND/OR Global South**	**Assessment Level (Scale): Food System AND/OR Farm System OR Specific Productions**	**Total**	**References**
ACT (Agroecology Criteria Tool)	1	4	1	1	1	3	2	1	2	2	18	[38–40]
Farm Level Agroecology Criteria Tool (F-ACT)	1	4	1	1	1	3	1	1	1	1	15	[41,42]
IDEA (The Indicateurs de Durabilité des Exploitations Agricoles)	1	2	1	2	1	1	4	1	2	1	16	[32,33,35,43–46]
Life Cycle Assessment—Agricultural	1	0	1	1	1	2	1	1	2	1	11	[47,48]
MLP (Multi-Level Perspective) on agro-food sustainability transitions	1	0	1	1	1	0	1	1	2	2	10	[49–54]
MESMIS (Marco para la evaluacion de los sistemas de manejo de recursos naturales)	1	1	1	1	1	1	3	1	1	2	13	[33,36,55,56]
RISE (Response-Inducing Sustainability Evaluation)	1	3	1	1	1	2	3	1	2	1	16	[32,33,44,46,57]
RHoMIS (Rural Household Multi-Indicator Survey)	1	3	1	1	1	2	2	1	1	1	14	[58–62]

Table 2. *Cont.*

	Normative Dimension	Procedural Dimension										
Methodology	**Goal Setting Approach: Bottom-Up (Stakeholder) OR Top-Down (Theory)**	**Methodology Simplicity: Graphic Visualization of the Results AND/OR Free Access to the Software AND/OR Easy to Access the Software AND/OR Free Access to the Tutorials**	**Time Requirement: More than 5 h OR between 3 and 5 h OR Less than 3 h**	**Assessment Purpose: Self-Assessment and Guidance OR Assessment and Guidance OR Multiple Purpose**	**Indicators' Reference Values: Target Values AND/OR Threshold Values AND/OR Relative Values**	**Indicators' Attributes: Predetermined Indicators AND/OR Specific Criteria for the Indicators' Selection Presented AND/OR Indicators' Interaction**	**End Users: Farmers AND/OR Policy Makers AND/OR Researchers AND/OR Educators**	**Stakeholders' Level of Participation: Whole Process OR Partial OR None**	**Applied on: Global North AND/OR Global South**	**Assessment Level (Scale): Food System AND/OR Farm System OR Specific Productions**	**Total**	**References**
TAPE (Tool for Agroecology Performance Evaluation)	1	2	1	1	2	3	3	1	2	2	18	[38,63–65]
SAFA (Sustainability Assessment of Food and Agriculture Systems)	1	2	1	1	1	2	3	0	2	2	15	[32,33,35,44,66]

The questionnaire, prepared with TAPE and ACT questions and criteria, was applied to eight farmers (six men and two women) ranging from 32 to 85 years old. Their educational backgrounds were diverse, ranging from fourth-grade educations to advanced degrees in subjects like philosophy, history, or the arts. Only one farmer had a degree in agronomy (Q5). The farmers had a variety of employment situations: four were retired, two were self-employed with employees, one was self-employed without employees (Q8), and one was an employee in other company (Q2). All farms were polycultural: seven farms included both animals and vegetables, and one included vegetables and olive trees (Q6). One farm does regenerative agriculture (Q8). The size of the farms ranged from 1 to 180 hectares, with the number of parcels ranging from 1 to 30 (Table 3).

Table 3. Farms (Q1 to Q8) and farmers' characterization.

	Farm				Farmer			
	Localization (Municipality)	**Type of Products**	**Type of Agriculture**	**Farm Size**	**Gender**	**Age**	**Education Level**	**Job Situation**
Q1	Vouzela (Centre of Portugal)	milk production/subsistence vegetable garden	conventional	1 ha/1 parcel	man	67	basic school	self-employed with employees
Q2	Vouzela (Centre of Portugal)	livestock/subsistence vegetable garden	conventional	6 ha/ 30 parcels	man	54	primary school	employed in another company
Q3	Viseu (Centre of Portugal)	livestock/subsistence vegetable garden	conventional	6 ha/30 parcels	human	72	primary school	retired
Q4	Arraiolos (South of Portugal)	vegetables/sheep	conventional	3 ha/2 parcels	man	85	primary school	retired
Q5	Évora (South of Portugal)	vegetables/sheep	conventional	180 ha/ 8 parcels	man	51	degree in agronomic engineering	self-employed with employees
Q6	Fundão (Centre of Portugal)	vegetables/olives	conventional	3 ha/1 parcel	man	76	degree in philosophy	retired
Q7	Fundão (Centre of Portugal)	vegetables/livestock	conventional	2 ha/ 25 parcels	man	66	degree in history	retired
Q8	Mangualde (Centre of Portugal)	vegetables/livestock	regenerative agriculture	10 ha/ 1 parcel	human	32	degree in arts	self-employed with no employees

Analyzing the results obtained on the eight farms by applying the TAPE Grid of Indicators (Table 4), Farm Q8 stands out in terms of agroecological performance, boasting an average rating of 2.8 (of a possible total of 4.0 values). Following Q8 closely is Farm Q7 (2.4 points). Farm Q8's distinction lies in its proficiency across a multitude of indicators. It obtained the highest score of 4 points on seven indicators, including 'Management of Soil Fertility' and 'Management of Pest and Diseases', and the second-highest score of 3 points on 16 indicators. Farm Q7 obtained a maximum score on two indicators, 'Appropriate Diet and Nutritional Awareness' and 'Local or Traditional Identity and Awareness', and secured a score of 3 on 15 indicators.

On the other hand, Farm Q6 presented the lowest recorded value (1.6), with a score of either 0 or 1 on eight indicators.

The assessment of agroecological performance across the surveyed farms reveals noteworthy trends. The highest average score of 3.0 was observed in two key areas: in 'Crops indicator from Diversity Element', indicating a consistent adoption of polycultural practices across all farms; and in 'Local or Traditional Identity' and 'Awareness from the Culture and Food Tradition Element'. The latter, together with the indicator 'Appropriate Diet and Nutrition Awareness', garners the second-highest average score of 2.9, emphasize the significant influence of local identity and cultural context on dietary choices. Within the 'Circular and Solidarity Economy Element', the indicator measuring 'Networks of Producers, Relationship with Consumers, and Presence of Intermediaries' also attains an average score of 2.9. Indeed, the existence of communication channels between producers and consumers, and the participation of agricultural or local development associations, has facilitated the contact with the family farmers interviewed.

Table 4. Results of the TAPE grid of indicators' application in the eight farms in the center and south of Portugal, in 2022. The value scored by each farm varies from 0 (less agroecological) to 4 (more agroecological).

FAO 10 Elements of Agroecology	Indicators	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Average Value per Indicator
Diversity	Crops	3	2	3	3	3	3	3	4	3.0
	Animals (including fish and insects)	1	1	3	2	3	0	2	3	1.9
	Trees (and other perennials)	1	2	2	3	2	2	3	4	2.4
	Diversity of activities, products, and services	1	0	2	1	2	1	2	2	1.4
Synergies	Crop–livestock–aquaculture integration	1	3	2	2	2	0	2	2	1.8
	Soil–plants system management	4	3	2	3	2	0	2	3	2.4
	Integration with threes	1	1	2	2	2	2	2	3	1.9
	Connectivity between elements of the agroecosystem and the landscape	1	3	3	3	2	1	2	3	2.3
Efficiency	Use of external inputs	2	3	1	2	2	1	2	3	2.0
	Management of soil fertility	4	4	1	2	2	1	3	4	2.6
	Management of pests and diseases	0	4	1	1	0	0	2	4	1.5
	Productivity and household needs	1	3	2	2	3	2	2	2	2.1
Recycling	Recycling of biomass and nutrients	4	3	2	2	3	0	1	3	2.3
	Water saving	0	2	1	1	2	2	3	3	1.8
	Management of seeds and breeds	1	3	3	3	1	1	1	3	2.0
	Renewable energy and production	0	0	1	0	1	0	1	2	0.6
Resilience	Stability of income/production and capacity to recover from perturbations	2	3	1	3	2	2	3	4	2.5
	Mechanisms for reducing vulnerability	4	3	0	0	3	3	3	2	2.3
	Environmental resilience and capacity to adapt to climate change	0	1	1	2	2	2	2	2	1.5
Culture and Food Tradition	Appropriate diet and nutrition awareness	3	3	2	3	3	3	4	2	2.9
	Local or traditional identity and awareness	3	3	2	3	3	3	4	3	3.0
	Use of local varieties/breeds and traditional knowledge for food preparation	2	2	3	3	2	3	3	2	2.5
Co-creation and Sharing of Knowledge	Platforms for the horizontal creation and transfer of knowledge and good practices	0	0	1	0	2	0	0	3	0.8
	Access to agroecological knowledge and interest of producers in agroecology	0	0	0	0	1	1	2	3	0.9
	Participation of producers in networks and grassroots organizations	2	3	2	3	3	3	3	2	2.6
Human and Social Values	Women's empowerment	3	1	2	2	2	3	2	3	2.3
	Labor (productive conditions, social inequalities)	2	1	0	2	3	2	2	2	1.8
	Youth empowerment and emigration	1	0	0	0	2	1	1	4	1.8
	Animal welfare [if applicable]	3	3	3	3	3	NA	3	3	2.1

Table 4. *Cont.*

FAO 10 Elements of Agroecology	Indicators	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Average Value per Indicator
Circular and Solidarity Economy	Products and services marketed locally	4	0	1	4	3	0	3	3	2.3
	Networks of producers, relationships with consumers, and presence of intermediaries	3	0	2	4	4	3	3	4	2.9
	Local food system	3	2	1	2	2	1	1	2	1.8
Responsible Governance	Producers' empowerment	1	1	1	2	3	3	3	1	1.9
	Producers' organizations and associations	2	1	3	1	3	3	3	3	2.4
	Participation of producers in governance of land and natural resources	0	2	3	0	0	3	3	0	1.4
	Average Value Per Farm	1.8	1.9	1.7	2.0	2.2	1.6	2.3	2.7	

Conversely, the lowest average score of 0.6 pertains to the 'Renewable Energy and Production' indicator within the 'Recycling' element. This suggests limited investment by the surveyed farmers in renewable energy production. Additionally, within the 'Co-creation and Sharing of Knowledge' element, two indicators, namely, 'Platforms for Horizontal Creation and Transfer of Knowledge and Good Practices' (scoring 0.8), and 'Access to Agroecological Knowledge and Producers' Interest in Agroecology' (scoring 0.9), had the lowest average scores. Despite their participation in producer networks, these farmers do not seem to perceive these platforms as conducive to knowledge exchange or co-creation. This is in line with the general perception that traditional cooperatives have failed, due to structural problems resulting from factors such as the atomization of farms, reduced innovation, low productivity, the advanced age of farmers, low levels of education, and aversion to risk [67].

Moreover, while certain practices closely align with agroecology, such as the adoption of polyculture and the promotion of local culture and traditions, the majority of the interviewed farmers remain unfamiliar with the conceptual framework of agroecology. Similar results were obtained in other Portuguese studies that evaluated the adoption of organic or regenerative practices [28,68,69]. This analysis underscores the fledgling status of agroecology in Portugal, particularly in light of the advanced age demographic of farmers (average age of 64), and their low education level (46.3% only completed primary school and 53.0% have only practical agricultural training) [70]. These demographic characteristics should be taken into consideration when formulating policies, programs, and initiatives, emphasizing the need for targeted efforts to disseminate and promote agroecological principles within the agricultural community.

The values obtained by Farm Q8 reveal important disparities. The lowest values obtained (0 and 1) are related to the lack of governance processes in the area where the farm is located (Mangualde municipality, in the Centre of Portugal). These results reveal the difficulty that farmers, especially family farmers, face in participating in governance structures even when there is still some support from local associations. The highest values (a value of 4) obtained by Farm Q8 are distributed among the elements 'Diversity' (the variety of crops and tree species planted is significant), 'Efficiency' (the management of soil fertility and of pests and diseases, using biological practices), 'Resilience' (income and production are stable and therefore able to increase annually, and there is the ability to recover fully and quickly after shocks/disturbances), 'Human and Social Values' (farming family of an young couple who see their future in farming and are keen to continue and improve their activity), and 'Circular and Solidarity Economy' (the farmers are part of a network of producers and have their own network of consumers—a Community Supporting Agriculture—CSA—to whom they deliver weekly baskets).

The analysis of the indicators of the FAO's 10 Elements of Agroecology (Step 1) reveals the intricate array of factors influencing the agroecological performance of a farm. Summarizing the key findings for each of the 10 elements:

(a) Diversity: As the farms are polycultural, they exhibit high degrees of diversity. However, the reduced diversity of practices, products, and services—in particular, that of Farms Q1, Q2, and Q6—negatively impacts their overall performance in this element.
(b) Synergies: The results obtained on the eight Farms are variable, meaning that there is some connectivity/interaction between crops/animals/landscape, although this is not consistent on the majority of the farms. The synergies that exist between the different components of production (on and off the farm) are very important and can be the lever for the agroecological transition of a farm.
(c) Efficiency: The use of synthetic pesticides and fertilizers, and the dependence on outside inputs, results in low values for the 'Management of Pests and Diseases' indicator for Farms Q1, Q5, and Q6. On all the farms surveyed, the valorization of residues may be improved.
(d) Recycling: Most farms have minimal energy production; instead, they often acquire energy from the market. Only two farms (Q7 and Q8) are identified as using water-saving techniques, information that underlines the importance of tackling resource management in the context of agroecological transition.
(e) Resilience: Most agroecosystems have a good capacity to adapt to climate irregularities, except Farm Q3, which faces challenges in income stability, vulnerability reduction mechanisms, and environmental resilience.
(f) Culture and Food Tradition: The majority of farmers demonstrate a strong awareness of local traditions and heritage, and a commitment to preserving them through traditional recipes and participation in local fairs and festivities.
(g) Co-creation and Sharing of Knowledge: While farmers are involved in networks and grassroots organizations, they generally have limited involvement in co-creation and knowledge-sharing initiatives. Awareness of agroecological principles and concepts is low for the majority of the famers interviewed. This factor can be related to the farmers' age and education levels.
(h) Human and Social Values: It is difficult to get young people interested in agriculture, and they are rarely present on most farms. Only Farm Q6 has employed a young woman with an interest in working in agriculture, specifically in animal production.
(i) Circular and Solidarity Economy: Six farms participate in networks of producers and consumers, selling locally and engaging with consumers. Only one farmer (Q8) is part of a CSA.
(j) Responsible Governance: Farmers rarely participate in governance processes, which points to a lack of local mechanisms for participation.

This detailed analysis provides a comprehensive understanding of the agroecological performance of and challenges faced by the surveyed family farms. It highlights areas where improvements can be made to enhance agroecological practices and sustainability. It also underscores the importance of addressing issues such as knowledge sharing, resource management, and youth engagement in agriculture to promote agroecological transition.

Concerning the application of the TAPE Step 2 (Evaluation of the 10 Criteria), Farms Q2 and Q8 had the most favorable outcomes, or "green lights" in 'Land Tenure', 'Income', 'Added Value', and 'Dietary Diversity'; Farm Q2 also achieved the best outcomes for 'Productivity' and 'Soil Health', and Farm Q8 for 'Pesticide Exposure' and 'Agricultural biodiversity'. In contrast, Farm Q5 showed a higher percentage of adverse indicators, or "red lights", in 'Income', 'Pesticide Exposure', 'Women's Empowerment', 'Youth Employment', and 'Agricultural biodiversity' (Table 5).

Table 5. Results of the application of the 10 Evaluation Criteria of TAPE (STEP 2) on the eight farms, in the center and south of Portugal, in 2022. In the table are the farms (Q1 to Q8). The value scored by each farm varies between 3 levels—desirable (green-G), acceptable (yellow-Y), and undesirable (red-R).

TAPE Traffic Light Approach	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Secure land tenure	G	G	G	G	G	G	G	G
Productivity	Y	G	R	G	Y	Y	G	R
Income	G	G	G	Y	R	Y	Y	G
Value added	G	G	R	G	G	G	G	G
Exposure to pesticides	R	R	G	R	R	R	Y	G
Dietary diversity	G	G	G	Y	G	G	G	G
Women's empowerment	R	R	Y	R	R	R	R	Y
Youth employment opportunity	R	R	R	R	R	R	R	R
Agricultural biodiversity	R	R	R	R	R	Y	G	G
Soil health	G	G	G	Y	G	Y	Y	Y

Summarizing the key findings for each of the 10 criteria:

(a) Land Tenure: No farms experience insecurity regarding land tenure, but there is a general concern about who will take over the land in the future.
(b) Productivity: Rather than the size or diversity of the farm, productivity varies. Some farms face challenges in registering their productivity due to the complexity of their activities.
(c) Income: For most farms, income has either remained stable or improved compared to previous years. Only one large-scale Farm (Q5) experienced a loss in income, most likely as a result of difficulties in the livestock sector.
(d) Added Value: Only one Farm (Q3) received a red light, indicating challenges in 'Adding Value', which can be explained by the farmer's health problems and the cost of maintaining the animals.
(e) Exposure to Insecticides: Only Farms Q3 and Q8 received a green light, as they use natural pesticides or implement biological crop protection practices.
(f) Dietary Diversity: Farm Q4 received a yellow light due to the farmer's limited diet, likely influenced by their advanced age.
(g) Women's Empowerment: Farms (Q3 and Q8) with female interviewees did not get a red light.
(h) Youth Employment Opportunities: All farms received a red light in this criterion, highlighting a need for providing opportunities for young people.
(i) Agrobiodiversity: Farms Q7 and Q8, with a higher number of crops, had a green light, while the others, with a red light, need to increase biodiversity.
(j) Soil Health: No farms received a red light, indicating good soil health. Farms Q1, Q6, and Q8, composed of a single plot, received a yellow light.

At last, with the application of ACT to the assessed farms, Farm Q8 attained the highest ACT score at 82%, whereas Farm Q4 achieved the lowest score at 27% (Table 6). The indicator with the highest score, registering at 94%, pertained to the 'Culture and Food Traditions' element. On the opposite end, the 'Responsible Governance' element, from Level 5: Rebuilding the Global Food System, scored 18% (Table 6).

Table 6. Results of ACT application on the eight farms (Q1 to Q8), in the center and south of Portugal, in 2022. Per-farm ACT provides the score (%) in each element of transition, linked with the levels of transition.

		Score (%)								
Level of Transition	**Element of Transition**	**Q1**	**Q2**	**Q3**	**Q4**	**Q5**	**Q6**	**Q7**	**Q8**	**Medium Value per Indicator**
Level 1: Increase efficiency of industrial and conventional practices	1.1. Efficiency	43	43	43	29	57	29	57	86	48
Level 2: Substitute industrial or conventional inputs with more sustainable alternatives	2.1. Recycling	17	17	33	17	33	0	33	83	29
	2.2. Regulation and balance	20	20	50	20	20	10	50	100	36
Level 3: Redesign whole agro-ecosystems	3.1. Synergies	25	25	38	25	50	0	38	88	36
	3.2. Diversity	78	67	89	56	89	78	89	89	79
	3.3. Resilience	33	33	33	33	33	67	67	100	50
Level 4: Re-establish connections between growers and eaters; develop alternative food networks	4.1. Circular and solidarity economy	67	100	100	33	67	33	67	100	71
	4.2. Culture and food traditions	100	100	100	50	100	100	100	100	94
	4.3. Co-creation and sharing of knowledge	0	67	67	33	67	33	67	100	54
Level 5: Rebuild the global food system so that it is sustainable and equitable for all	5.1. Human and social value	17	17	83	0	83	17	83	33	42
	5.2. Responsible governance	0	40	20	0	20	20	20	20	18
	Medium value per farm	36	48	60	27	56	35	61	82	

Summarizing the key findings for each of the 11 elements of transition:

(a) Efficiency: Farm Q8 scored the highest, at 86%, while Farms Q4 and Q6 scored the lowest (29%). Farm Q8 has adopted practices such as water consumption reduction techniques, non-use of pesticides and veterinary drugs, efficient animal-feed utilization, solar energy adoption, and product dehydration and drying, as well as the use and conservation of traditional seeds. Farms Q4 and Q6 employed some of these efficient practices, though to a lesser extent.

(b) Recycling: Farm Q8 garnered the highest score, at 86%, whereas Farm Q6 attained the lowest score, at 0%. Farm Q8 uses alternative soil inputs, incorporates green manure, recycles wastewater, utilizes biomass residue for energy generation, and alternative methods of climate mitigation.

(c) Regulation and Balance (the element included in addition to the 10 from FAO): Farm Q8 achieved the highest score, at 100%, while Farm Q6 scored the lowest, at 10%. Farm Q8 implements a range of practices, including biological pest management, cover cropping for pest control and improved soil conditions, reduced tillage, adoption of organic and low-input farming, utilization of domesticated pollinators, and improved animal welfare and health. In contrast, Farm Q6 primarily relies on perennial crops.

(d) Synergies: Farm Q8 attained the highest score, at 88%, and Farm Q6 attained the lowest score, at 0%. Farm Q8's practices include non-crop plant cultivation, agroforestry, rotational/regenerative grazing, integrated crop–livestock systems, integrated pest management through habitat manipulation, and climate mitigation through system redesign.

(e) Diversity: Farms Q3, Q5, Q7, and Q8 demonstrated the highest scores, at 89%, and Farm Q4 obtained the lowest score, at 56%. The high-scoring farms implement practices as improving local seed and breed diversity, integrating locally adapted crops and breeds, practicing polycultural cultivation, managing heterogeneous landscapes, and conserving the forest around agricultural lands. In contrast, Q4 places less emphasis on these practices.

(f) Resilience: Five farms (Q1 to Q5) achieved the lowest score of 33%, by focusing primarily on livelihood resilience through diversified income sources. In contrast, Farm Q8 attained the highest score of 100%, due to its additional emphasis on systemic resilience to extreme weather events and disturbances, as well as its adaptive capacity to changing environmental conditions.

(g) Circular and Solidarity Economy: Farms Q4 and Q6 received the lowest score of 33%, while Farms Q2, Q3, and Q8 achieved the highest score of 100%. This reflects their active involvement in supporting regional value generation, re-establishing the connection between producers and consumers, and their advocacy for seasonal and regional demand.

(h) Culture and Food Traditions: All farms except Q4 achieved the highest score of 100%. These farms endorse healthy, diversified, and culturally appropriate food traditions and diets. Farm Q4, however, is not affiliated with farmers' associations or other platforms for policy support.

(i) Co-Creation and Sharing of Knowledge: Farm Q8 scored the highest, at 100%, and Farm Q1 obtained the lowest score, at 0%. Farm Q8 actively engages with fellow farmers to exchange knowledge, participates in participatory and multi-stakeholder knowledge-generation approaches, and advocates for formal and informal production and food education.

4. Discussion

Revisiting the results, the indicators that scored the highest on the TAPE grid of indicators were 'Crops', from the 'Diversity' element, and 'Local or Traditional identity awareness', from the 'Culture and Food Tradition' element, with both achieving values of 3.0; meanwhile, the ones that scored the lowest were 'Renewable Energy' and 'Production' from the 'Recycling' element, with both obtaining values of 0.6. The criterion of the TAPE 10 Evaluation Criteria that received green lights from all farms was 'Land Tenure', and the one that received red lights from all farms was 'Youth employment opportunities'. Turning to ACT, the indicator that scored the highest was 'Culture and food traditions' (94%) and the one that scored the lowest was 'Responsible Governance' (18%).

Merging TAPE Grid of indicators, TAPE 10 Evaluation Criteria and ACT results are consistent for the best agroecological performance (Table 7). Farm Q8 scored the highest both in TAPE Grid of Indicators (2.8 values), had the highest number of green lights (six green lights), and scored the highest in ACT (82%), which means that its agroecological performance is better than that of the others. It is a regenerative family farm run by two young designers who transitioned from urban to rural life. They cultivate blueberries, vegetables, fruits, and eggs, distributing their produce through a CSA model. On the other hand, the farm that score the lowest on the TAPE grid of indicators was Farm Q6 (1.6 values), while the farm that had the highest number of red lights using TAPE 10 evaluation criteria was Farm Q5 (five red lights) and the farm that scored the lowest on the ATC was Farm Q4 (27%).

Table 7. Results of the TAPE grid of indicators' average values per farm, TAPE 10 evaluation criteria (number of green lights and number of red lights), and ATC medium value per farm, on eight farms (Q1 to Q8), in the center and south of Portugal, in 2022.

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Tape Grid of Indicators Average values per farm	1.8	1.9	1.8	2.0	2.3	1.6	2.4	2.8
Tape 10 Evaluation Criteria (number of green lights obtained)	5	6	5	3	4	3	5	6
Tape 10 Evaluation Criteria (number of red lights obtained)	4	4	4	4	5	3	2	2
ACT medium value per farm	36	48	60	27	56	35	61	82

Upon comparing the values across the elements of transition in the TAPE grid of indicators (after converting to percentages) and in ACT, it becomes evident that while 'Culture and Food Transitions' received the highest score in both assessments (73% in the TAPE grid of indicators and 94% in ACT), the lowest scoring elements differ (Table 8). Specifically, 'Co-Creation and Sharing of Knowledge' achieved 23% in the TAPE grid of indicators (and 54% in ATC), while' Responsible Governance' scored 18% in ACT (and 54% in the TAPE grid of indicators), indicating a notable discrepancy.

Table 8. Results of the TAPE grid of indicators' average values, converted into percentages, and the ATC medium score by element of transition, on eight farms evaluated in the center and south of Portugal, in 2022.

Elements/Elements of Transition	TAPE Grid of Indicators *	ACT
Diversity	53	79
Synergies	53	36
Efficiency	53	48
Recycling	48	29
Resilience	55	50
Culture and food traditions	73	94
Co-creation and sharing of knowledge	23	54
Human and social value	50	42
Circular and solidarity economy	58	71
Responsible governance	48	18
Regulation and balance	NA	36

* values converted in %.

Nevertheless, several disparities are observed. For instance, when examining parameters related to young people and women, the focus on distinct aspects within the overarching theme leads to differential measurements. Regarding 'Youth', the TAPE grid of indicators' questions focus on youth empowerment and emigration, how young people see their future in agriculture, whether they are happy with the working conditions, or whether they intend to emigrate. The TAPE evaluation criteria add information about education and training, and ACT only mentions women and youth in the criterion 'Gender and Vulnerable Group Approach'. With regard to women, the TAPE indicator grid includes questions about women's empowerment, their access to decision-making power over productive resources, and the existence and functionality of women's organizations. The TAPE evaluation criteria add information on 'Control over the use of income'; 'Leadership in the community'; and 'Use of time'.

The analysis of the questions supporting the evaluation of the elements 'Culture and Food traditions', 'Co-creation and Sharing of Knowledge', and 'Responsible Governance', revealed that ACT incorporates more comprehensive inquiries. For instance, ACT includes questions about the right to adequate and culturally appropriate food, the support for individuals' decision-making regarding food sourcing and consumption (in 'Culture and Food traditions'), the farmers networks, the formal and non-formal education networks (in 'Co-creation and Sharing of Knowledge'), and the intersection of agroecology and global change (in 'Responsible Governance'), which are not included in the TAPE Grid of Indicators (Table 9).

Table 9. Indicators from the TAPE grid and transition criteria from the ACT for the elements Culture and Food Traditions, Co-creation and Sharing of Knowledge, and Responsible Governance.

Elements	Tape Indicators	Act Transition Criteria
Culture and food traditions	Appropriate diet and nutrition awareness	Support healthy, diversified and culturally appropriate food traditions and diets
	Local or traditional identity and awareness	Support the right to adequate and culturally appropriate food
	Use of local varieties/breeds and traditional knowledge for food preparation	
Co-creation and sharing of knowledge	Platforms for the horizontal creation and transfer of knowledge and good practices	Connecting farmers to share knowledge
	Access to agroecological knowledge and interest of producers in agroecology	Promote formal and non-formal "production and food" education
	Participation of producers in networks and grassroot organizations	Promote participatory and multi-stakeholder approaches in knowledge generation
Responsible governance	Producers' empowerment	Policy development on producer-consumer links
	Producers' organizations and associations	Inclusive policy-making that aim for sustainable and equitable food system
	Participation of producers in governance of land and natural resources	Establishment of equitable governance and rights over natural resources
		Policy development on the links between agroecology and global changes
		Policy development that rewards agricultural management that enhances biodiversity and the provision of ecosystem services

Contrary to the TAPE grid of indications (based on 35 indicators), the ACT is built around 62 transition criteria. The unique features of ACT are justified by this divergence. As opposed to ACT, which uses a binary "Yes or No" response format that could make it difficult to evaluate how agroecological performance on farms, the TAPE grid of indicators offers a more accurate assessment of indicator status—important information to evaluate the farms agroecological performance.

5. Conclusions

The TAPE grid of indicators, TAPE 10 evaluation criteria, and ACT collectively enable the assessment of agroecological performance of family farms. However, certain questions require adaptation to align with the Portuguese, and other European, cultural and territorial contexts. Examples include inquiries about women's associations, on-farm employability, local food systems, land inheritance, and emerging opportunities like agrotourism. The findings of this study are aligned with Anthonioz [63] who applied TAPE to livestock production in a region of France, pointing out that the results of some indicators, such as women's empowerment, may not be significant when applied to European agricultural systems. Marino [71], in their analysis of the food system in the city region of Rome (Italy),

applied an adaptation of the TAPE, noting its focus of application in developing countries. Steglich [72] in their work for the Global South, also applied an adaptation of TAPE in which they included indicators for assessing the presence of local non-agricultural sectors such as forestry, nature, and landscape conservation, renewable energies, and tourism In addition, Colbert [38] analyzed both TAPE and ACT within demonstration farms in Kenya and indicated that the high level of detail of TAPE, as well as the time technical knowledge required to study it, makes it less accessible to those not working in research. He claims that with slight modifications, ACT can be an easy tool for demonstration farms (as well as farmers) to assess how their activities are contributing to the agroecological transition, whether at the farm, field, market, or policy level.

In applying TAPE and ACT to Portuguese family farmers, questions pertaining to agricultural biodiversity and soil health pose challenges for farmers due to limited access to organized information. It is crucial to consider whether these constraints stem from factors related to the agroecosystem itself (such as size and cultural diversity), the local food system, or the characteristics of the farmers and stakeholders involved including their age, education, training, and time available. Both formal and informal education on agroecology practices (at the agroecosystem and food system level) are of the utmost importance yet, at present, are practically non-existent in Portugal. In the realm of family farming, the results indicate that the agroecological transition is primarily influenced by the socio-economic attributes of the farmers, rather than the geographic location or size/number of plots of the farms. Despite applying practices considered agroecological, such as polyculture and animal inclusion, most farmers lack familiarity with the concept of agroecology and possess a limited systemic understanding of agriculture and local food dynamics. Evaluating the agroecological performance of farms is just as important for farms already committed to the agroecological transition (consolidating existing efforts) as it is for those unfamiliar with the concept (supporting the transition process).

This study made it possible to identify the most relevant aspects for characterizing family farmers and their farms. It also made it possible to perceive the importance of how the evaluation criteria/indicators are ordered by element/theme, as it alters the values of each farm's agroecological performance. Thus, based on the analyses conducted and considering that the methodology to be developed aims to support the design of policies for agroecological transition, it was possible to identify a set of questions crucial for evaluating farms' agroecological performance, which might be organized into 10 topics (within the Agroecosystem and the Local/Global Food System):

Within the Agroecosystem:

(a) Plant Production: evaluates the diversity of crops over space and time, considering factors like monoculture versus polyculture, as well as the integration of different crops. It also examines the origin of plants and seeds.
(b) Animal Production: focuses on the presence and diversity of animals on the farm, emphasizing animal welfare. It considers factors such as multiple species, the integration of animals with crops, and their well-being.
(c) Soil Regeneration: assesses practices related to recycling biomass, incorporating organic matter into the soil, soil cover, and conservation practices. It also considers the quantity of tillage activities.
(d) Regenerating the Water Cycle: addresses water-related aspects, including the source of water, controlled irrigation, water recovery, and its destination. It also evaluates water quality.
(e) Pest, Disease, and Weed Management: focuses on how the farm monitors and manages pests, diseases, and weeds. It considers decision-making processes and intervention methods.
(f) Ecological Synergies (Functional Biodiversity): examines the integration of trees, crops, and animals. Additionally, it assesses the biodiversity on the farm as well as in its surroundings, including nearby farms.

(g) Economic Synergies (Management of Production Factors/Farm Management): considers the balance between internal and external factors in production. It looks at factors like seeds, plants, fertilizers, and farm machinery. It also includes record-keeping of various activities.
(h) Social Synergies (Well-Being on the Farm): evaluates aspects related to the well-being of individuals on the farm, including fair compensation, safety, rest time, gender equity, youth empowerment, and participation in decision-making processes. It also considers the farm's contribution to the community and its adherence to cultural and food traditions.

Within the Local/Global Food System:

(i) Interactions with the Local Food System: assesses the farm's relationships with the local community, including proximity to consumers, markets, and institutions. It also considers formal and informal networks between producers and producers and consumers.
(j) Sharing Local/Global Agroecological Knowledge: focuses on the sharing and co-construction of agroecological knowledge among various actors in the food system, both locally and globally.

The created methodology will involve conducting questionnaires with farmers during on-site visits, mapping out the farm areas, and performing soil analyses. The collected data will then be used to assess a set of indicators, combining elements from both the TAPE Grid of Indicators and ACT Criteria for Transition, positioning the indicators at the agroecosystem level or the food system. Additionally, discussions with respondents about the results will be held, a crucial step for farmers to take ownership of the findings. This process aids in identifying solutions and establishing collective paths forward, enhancing interaction among all involved stakeholders.

Two limitations of this study are important to mention. The first relates to the size of the sample: the questionnaires were applied to just eight farms. Despite the difficulties of applying them to a larger sample, especially due to the duration of the interviews, a larger number of assessed farms would have allowed for better understanding of the advantages and limitations of both TAPE and ACT methodologies in the Portuguese context. The second concerns the non-application of the four steps of the TAPE, which can condition the perception of the purpose of each question. Regarding TAPE Stage 0, due to the fact that the questionnaire was applied in two different regions, the gathering of local information relevant to the agroecological transition was not carried out. This information would be important for TAPE Stage 3, centered on returning to the territories to reflect on the results obtained, together with the farmers, and achieving a better understanding of agroecology. However, the conclusions reached for the creation of the methodology were in line with the results of other studies being carried out simultaneously in Portugal and with the bibliography of similar research being carried out in other countries. A more generalized application of these methodologies in Portugal aligned with other countries is, therefore, necessary in order to understand their adaptability in the context of family farming.

Author Contributions: Conceptualization: I.C.-P. and C.A.C. Investigation: I.C.-P., C.A.C., F.D. and A.A.R.M.A. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by National Funds through the FCT—Foundation for Science and Technology, I.C.-P., within the scope of the individual doctoral research grant reference UI/BD/153087/2022.

Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki, and approved by the Ethics Committee of Polytechnic of Viseu, approval code: Parecer no55/SUB/2021, date of approval: 22 June 2021.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: Data are contained within the article.

Acknowledgments: We would like to thank CERNAS funded by national funds FCT—Foundation for Science and Technology, I.P., within the scope of the project Ref. UIDB/00681/2020, the GreenUPorto funded by national funds via FCT (Foundation for Science and Technology) through the Strategic Projects UIDB/05748/2020 and UIDP/05748/2020, DOI https://doi.org/10.54499/UIDP/05748/2020 and https://doi.org/10.54499/UIDB/05748/2020 and Valorizar a Agricultura Familiar Project (PDR2020-2024-058135) for the opportunity of applying the questionnaires within the scope of its research.

Conflicts of Interest: The authors declare no conflicts of interest.

References

1. Tudi, M.; Ruan, H.D.; Wang, L.; Lyu, J.; Sadler, R.; Connell, D.; Chu, C.; Phung, D.T. Agriculture Development, Pesticide Application and Its Impact on the Environment. *Int. J. Environ. Res. Public Health* **2021**, *18*, 1112. [CrossRef]
2. van der Sluijs, J.P. Insect decline, an emerging global environmental risk. *Curr. Opin. Environ. Sustain.* **2020**, *46*, 39–42. [CrossRef]
3. Beketov, M.A.; Kefford, B.J.; Schäfer, R.B.; Liess, M. Pesticides reduce regional biodiversity of stream invertebrates. *Proc. Natl. Acad. Sci. USA* **2013**, *110*, 11039–11043. [CrossRef] [PubMed]
4. Goulson, D. An overview of the environmental risks posed by neonicotinoid insecticides. *J. Appl. Ecol.* **2013**, *50*, 977–987. [CrossRef]
5. Geiger, F.; Bengtsson, J.; Berendse, F.; Weisser, W.W.; Emmerson, M.; Morales, M.B.; Ceryngier, P.; Liira, J.; Tscharntke, T.; Winqvist, C.; et al. Persistent negative effects of pesticides on biodiversity and biological control potential on European farmland. *Basic Appl. Ecol.* **2010**, *11*, 97–105. [CrossRef]
6. Matson, P.A.; Parton, W.J.; Power, A.G.; Swift, M.J. Agricultural Intensification and Ecosystem Properties. *Science* **1997**, *277*, 504–509. [CrossRef] [PubMed]
7. Alif, S.M.; Dharmage, S.C.; Benke, G.; Dennekamp, M.; Burgess, J.A.; Perret, J.L.; Lodge, C.J.; Morrison, S.; Johns, D.P.; Giles, G.G.; et al. Occupational exposure to pesticides are associated with fixed airflow obstruction in middle-age. *Thorax* **2017**, *72*, 990–997. [CrossRef]
8. Damalas, C.A.; Koutroubas, S.D. Farmers' Exposure to Pesticides: Toxicity Types and Ways of Prevention. *Toxics* **2016**, *4*, 1. [CrossRef] [PubMed] [PubMed Central]
9. Smith, M.R.; Singh, G.M.; Mozaffarian, D.; Myers, S.S. Effects of decreases of animal pollinators on human nutrition and global health: A modelling analysis. *Lancet* **2015**, *386*, 1964–1972. [CrossRef] [PubMed]
10. Tilman, D.; Clark, M. Global diets link environmental sustainability and human health. *Nature* **2014**, *515*, 518–522. [CrossRef]
11. Quintas-Soriano, C.; Buerkert, A.; Plieninger, T. Effects of land abandonment on nature contributions to people and good quality of life components in the Mediterranean region: A review. *Land Use Policy* **2022**, *116*, 106053. [CrossRef]
12. Leal Filho, W.; Mandel, M.; Al-Amin, A.Q.; Feher, A.; Chiappetta Jabbour, C.J. An assessment of the causes and consequences of agricultural land abandonment in Europe. *Int. J. Sustain. Dev. World Ecol.* **2016**, *24*, 554–560. [CrossRef]
13. Terres, J.-M.; Scacchiafichi, L.N.; Wania, A.; Ambar, M.; Anguiano, E.; Buckwell, A.; Coppola, A.; Gocht, A.; Källström, H.N.; Pointereau, P.; et al. Farmland abandonment in Europe: Identification of drivers and indicators, and development of a composite indicator of risk. *Land Use Policy* **2015**, *49*, 20–34. [CrossRef]
14. Wezel, A.; Herren, B.G.; Kerr, R.B.; Barrios, E.; Gonçalves, A.L.R.; Sinclair, F. Agroecological principles and elements and their implications for transitioning to sustainable food systems. *A review. Agron. Sustain. Dev.* **2020**, *40*, 40. [CrossRef]
15. Loconto, A.M.; Fouilleux, E. Defining agroecology: Exploring the circulation of knowledge in FAO's Global Dialogue. *Int. J. Sociol. Agric. Food* **2019**, *25*, 116–137. [CrossRef]
16. Teixeira, H.M.; Van den Berg, L.; Cardoso, I.M.; Vermue, A.J.; Bianchi, F.J.J.A.; Peña-Claros, M.; Tittonell, P. Understanding Farm Diversity to Promote Agroecological Transitions. *Sustainability* **2018**, *10*, 4337. [CrossRef]
17. Altieri, M.A.; Nicholls, C.I. Agroecology: Challenges and opportunities for farming in the Anthropocene. *Int. J. Agric. Nat. Resour.* **2020**, *47*, 204–215. [CrossRef]
18. Blay-Palmer, A.; Sonnino, R.; Custot, J. A food politics of the possible? Growing sustainable food systems through networks of knowledge. *Agric. Hum. Values* **2015**, *33*, 27–43. [CrossRef]
19. Wezel, A.; Bellon, S.; Doré, T.; Francis, C.; Vallod, D.; David, C. Agroecology as a science, a movement and a practice. A review. *Agron. Sustain. Dev.* **2009**, *29*, 503–515. [CrossRef]
20. Méndez, V.E.; Caswell, M.; Gliessman, S.R.; Cohen, R. Integrating Agroecology and Participatory Action Research (PAR): Lessons from Central America. *Sustainability* **2017**, *9*, 705. [CrossRef]
21. Nicholls, C.I.; Altieri, M.A.; Vazquez, L. Agroecology: Principles for the Conversion and Redesign of Farming Systems. *J. Ecosys. Ecograph.* **2016**, *S5*, 010. [CrossRef]
22. Wezel, A.; Casagrande, M.; Celette, F.; Vian, J.-F.; Ferrer, A.; Peigné, J. Agroecological practices for sustainable agriculture. A review. *Agron. Sustain. Dev.* **2013**, *34*, 1–20. [CrossRef]
23. Gliessman, S.R. *Agroecology: The Ecology of Sustainable Food Systems*, 3rd ed.; CRC Press/Taylor and Francis: BocaRaton, FL, USA, 2015. [CrossRef]
24. Viegas, M. Construção de um índice sintético aplicado à agricultura familiar no continente português. *Rev. Voz Campo* **2022**, novembro.

25. FAO; IFAD. The Future of Family Farming in the Context of the 2030. 2019. Available online: https://www.ifad.org/documents/38714174/41167968/UNDFF+Background_Document.pdf/f8a7ed38-996b-96a8-9ab4-5c53ab0779f2 (accessed on 30 November 2022).
26. Garner, E.; De la O Campos, A.P. Identifying the "family farm": An informal discussion of the concepts and definitions. In *ESA Working Paper*; No. 14-10; FAO: Rome, Italy, 2014. [CrossRef]
27. Aguiar, A.; Parente, C.; Costa, D.; Correia, H.E.; Guiné, R.; Correia, E.; Chaves, C. (Eds.) *Pontes Entre Agricultura Familiar e Agricultura Biológica*; Agricultura Familiar no Norte e Centro de Portugal: Práticas de Agricultura Sustentável in Costa, C.A. (Coord); Centro de Estudos Ibéricos, Coleção Iberiografias No. 37: Guarda, Portugal, 2020; pp. 181–184. ISBN 978-972-780-717-8.
28. da Costa, C.A.; Guiné, R.; Correia, H.E.; Costa, D.T.; Costa, T.; Parente, C.; Pais, C.; Gomes, M.; Aguiar, A.A. Agricultura familiar e proteção das culturas: Abordagens tradicionais e proximidade com práticas de agricultura biológica. *Rev. Ciências Agrárias* **2018**, *41*, 164–173. [CrossRef]
29. Alvarez, R. Comparing Productivity of Organic and Conventional Farming Systems: A Quantitative Review. *Arch. Agron. Soil Sci.* **2021**, *68*, 1947–1958. [CrossRef]
30. Landini, F.; Beramendi, M.R. Agroecology or modern conventional agriculture? Positionings of Argentine rural extension workers. *Adv. Mod. Cult.* **2020**, *46*, 352–361.
31. Wiget, M.; Müller, A.; Hilbeck, A. Main challenges and key features of indicator-based agroecological assessment frameworks in the context of international cooperation. *Ecol. Soc.* **2020**, *25*, 25. [CrossRef]
32. de Olde, E.M.; Oudshoorn, F.W.; Sørensen, C.A.; Bokkers, E.A.; de Boer, I.J. Assessing sustainability at farm-level: Lessons learned from a comparison of tools in practice. *Ecol. Indic.* **2016**, *66*, 391–404. [CrossRef]
33. Bonisoli, L.; Galdeano-Gómez, E.; Piedra-Muñoz, L. Deconstructing criteria and assessment tools to build agri-sustainability indicators and support farmers' decision-making process. *J. Clean. Prod.* **2018**, *182*, 1080–1094. [CrossRef]
34. Nicholls, C.; Altieri, M.; Kobayashi, M.; Tamura, N.; McGreevy, S.; Hitaka, K. Assessing the agroecological status of a farm: A principle-based assessment tool for farmers. *Sustain. Agric.* **2020**, *48*, 29–41. [CrossRef]
35. Binder, C.R.; Feola, G.; Steinberger, J.K. Considering the normative, systemic and procedural dimensions in indicator-based sustainability assessments in agriculture. *Environ. Impact Assess. Rev.* **2010**, *30*, 71–81. [CrossRef]
36. Talukder, B.; Blay-Palmer, A. Comparison of Methods to Assess Agricultural Sustainability. *Sustain. Agric. Rev.* **2017**, *25*, 149–168. [CrossRef]
37. Gliessman, S.R. Transforming food systems with agroecology. *Agroecol. Sustain. Food Syst.* **2016**, *40*, 187–189. [CrossRef]
38. Colbert, E. The Role of Demonstration Farms in Agroecological Transitions: Nexus for Scaling up and Scaling out Agroecology. Master's Thesis, Norwegian University of Life Sciences (NMBU) & Institut Superior d'Agriculture Rhône-Alpes (ISARA), As, Norway, 2020. Available online: https://nmbu.brage.unit.no/nmbu-xmlui/bitstream/handle/11250/2724492/Edd%20Colbert_MSc%20Thesis_2020_NMBU.pdf?sequence=3 (accessed on 3 October 2022).
39. Achterberg, E.; Quiroz, D. *Development Aid Funds for Agroecology Support for Agroecology of Dutch ODA Spending*; Profundo: Amsterdam, The Netherlands, 2021; Report Profundo. Available online: https://www.bothends.org/en/ (accessed on 10 January 2023).
40. *ACT (Agroecology Criteria Tool)*; Biovision: Milpitas, CA, USA, 2015. Methodology | Criteria Tool | Agroecology Info Pool. Available online: https://www.agroecology-pool.org/methodology/ (accessed on 3 October 2022).
41. Burns, S.; Dittmer, K.M.; Shelton, S.W.; Wollenberg, E.K. *Exemplary Features of Digital Tools for Agroecology? A Global Review*; Alliance of Bioversity and CIAT: Rome, Italy, 2022. Available online: https://cgspace.cgiar.org/bitstream/handle/10568/126016/ATDT%20Digital%20Tool%20Review_Agroecology%20Brief_Dec2022.pdf?sequence=1 (accessed on 10 January 2023).
42. *F-ACT (Farm Level Agroecology Criteria Tool)*; Biovision: Milpitas, CA, USA, 2019. Available online: https://www.agroecology-pool.org/fact/ (accessed on 3 October 2022).
43. Zahm, F.; Viaux, P.; Vilain, L.; Girardin, P.; Mouchet, C. Assessing Farm Sustainability with the IDEA Method—From the Concept of Agriculture Sustainability to Case Studies on Farms. *Sustain. Dev.* **2008**, *16*, 271–281. [CrossRef]
44. Valizadeh, N.; Hayati, D. Development and validation of an index to measure agricultural sustainability. *J. Clean. Prod.* **2020**, *280*, 123797. [CrossRef]
45. Marchand, F.; Debruyne, L.; Triste, L.; Gerrard, C.; Padel, S.; Lauwers, L. Key characteristics for tool choice in indicator-based sustainability assessment at farm level. *Ecol. Soc.* **2014**, *19*, 46. [CrossRef]
46. Trabelsi, M.; Mandart, E.; Le Grusse, P.; Bord, J.-P. How to measure the agroecological performance of farming in order to assist with the transition process. *Environ. Sci. Pollut. Res.* **2015**, *23*, 139–156. [CrossRef]
47. Fan, J.; Liu, C.; Xie, J.; Han, L.; Zhang, C.; Guo, D.; Niu, J.; Jin, H.; McConkey, B.G. Life Cycle Assessment on Agricultural Production: A Mini Review on Methodology, Application, and Challenges. *Int. J. Environ. Res. Public Health* **2022**, *19*, 9817. [CrossRef] [PubMed]
48. van der Werf, H.M.G.; Knudsen, M.T.; Cederberg, C. Towards better representation of organic agriculture in life cycle assessment. *Nat. Sustain.* **2020**, *3*, 419–425. [CrossRef]
49. Geels, F.W. The multi-level perspective on sustainability transitions: Responses to seven criticisms. *Environ. Innov. Soc. Transit.* **2011**, *1*, 24–40. [CrossRef]
50. El Bilali, H. Transition heuristic frameworks in research on agro-food sustainability transitions. *Environ. Dev. Sustain.* **2020**, *22*, 1693–1728. [CrossRef]

51. El Bilali, H. The Multi-Level Perspective in Research on Sustainability Transitions in Agriculture and Food Systems: A Systematic Review. *Agriculture* **2019**, *9*, 74. [CrossRef]
52. López-García, D.; Cuéllar-Padilla, M.; Olival, A.d.A.; Laranjeira, N.P.; Méndez, V.E.; Parada, S.P.Y.; Barbosa, C.A.; Salas, C.B.; Caswell, M.; Cohen, R.; et al. Building agroecology with people. Challenges of participatory methods to deepen on the agroecological transition in different contexts. *J. Rural. Stud.* **2021**, *83*, 257–267. [CrossRef]
53. Sarabia, N.; Peris, J.; Segura, S. Transition to agri-food sustainability, assessing accelerators and triggers for transformation: Case study in Valencia, Spain. *J. Clean. Prod.* **2021**, *325*, 129228. [CrossRef]
54. Cruz, J.F.; Mena, Y.; Rodríguez-Estévez, V. Methodologies for assessing sustainability in farming systems. *Sustain. Assess. Report.* **2018**, *3*, 33–58. [CrossRef]
55. López-Ridaura, S.; Masera, O.; Astier, M. Evaluating the sustainability of complex socio-environmental systems. The MESMIS framework. *Ecol. Indic.* **2002**, *2*, 135–148. [CrossRef]
56. *RISE (Response-Inducing Sustainability Evaluation)*; Bern University: Bern, Switzerland, 1999. Available online: https://www.bfh.ch/hafl/en/research/reference-projects/rise/ (accessed on 3 October 2022).
57. Hammond, J.; Fraval, S.; van Etten, J.; Suchini, J.G.; Mercado, L.; Pagella, T.; Frelat, R.; Lannerstad, M.; Douxchamps, S.; Teufel, N.; et al. The Rural Household Multi-Indicator Survey (RHoMIS) for rapid characterisation of households to inform climate smart agriculture interventions: Description and applications in East Africa and Central America. *Agric. Syst.* **2017**, *151*, 225–233. [CrossRef]
58. Périnelle, A.; Scopel, E.; Berre, D.; Meynard, J.-M. Which Innovative Cropping System for Which Farmer? Supporting Farmers' Choices Through Collective Activities. *Front. Sustain. Food Syst.* **2022**, *6*, 753310. [CrossRef]
59. Fraval, S.; Hammond, J.; Wichern, J.; Oosting, S.J.; DE Boer, I.J.M.; Teufel, N.; Lannerstad, M.; Waha, K.; Pagella, T.; Rosenstock, T.S.; et al. Making the most of imperfect data: A critical evaluation of standard information collected in farm household surveys. *Exp. Agric.* **2018**, *55*, 230–250. [CrossRef]
60. Ritzema, R.; Douxchamps, S.; Fraval, S.; Bolliger, A.; Hok, L.; Phengsavanh, P.; Long, C.; Hammond, J.; van Wijk, M. Household-level drivers of dietary diversity in transitioning agricultural systems: Evidence from the Greater Mekong Subregion. *Agric. Syst.* **2019**, *176*, 102657. [CrossRef]
61. *RHoMIS (Rural Household Multi-Indicator Survey)*; ILRI: Addis Ababa, Ethiopia, 2015. Available online: https://www.rhomis.org/ (accessed on 4 October 2022).
62. Namirembe, S.; Mhango, W.; Njoroge, R.; Tchuwa, F.; Wellard, K.; Coe, R. Grounding a global tool-Principles and practice for agroecological assessments inspired by TAPE. *Elem. Sci. Anthr.* **2022**, *10*, 00022. [CrossRef]
63. Anthonioz, A. The Suitability of the "Tool for Agroecological Performance Evaluation" (TAPE) in a European Context. Master's Thesis, Norwegian University of Life Sciences & ISARA, As, Norway, 2021. Available online: https://www.agroscope.admin.ch/dam/agroscope/de/dokumente/aktuell/Veranstaltungen/a-nachhaltigkeitstagung/2022/01-mottet.pdf.download.pdf/01_NHT_2022_Anne_Mottet_26012022%20light_update.pdf (accessed on 3 October 2022).
64. Mottet, A.; Bicksler, A.; Lucantoni, D.; De Rosa, F.; Scherf, B.; Scopel, E.; López-Ridaura, S.; Gemmil-Herren, B.; Kerr, R.B.; Sourisseau, J.-M.; et al. Assessing Transitions to Sustainable Agricultural and Food Systems: A Tool for Agroecology Performance Evaluation (TAPE). *Front. Sustain. Food Syst.* **2020**, *4*, 579154. [CrossRef]
65. *TAPE (Tool for Agroecology Performance Evaluation)*; FAO: Rome, Italy, 2018. Tools | Agroecology Knowledge Hub | Food and Agriculture Organization of the United Nations. Available online: https://www.fao.org/agroecology/tools-tape/en/ (accessed on 4 October 2022).
66. *SAFA (Sustainability Assessment of Food and Agriculture Systems)*; FAO: Rome, Italy, 2014. Available online: https://www.fao.org/nr/sustainability/sustainability-assessments-safa/safa-tool/en/ (accessed on 3 October 2022).
67. Rebelo, J.; Vaz Caldas, J. *Support for Farmers' Cooperatives*; Country Report Portugal; Wageningen UR: Wageningen, The Netherlands, 2012. Available online: https://edepot.wur.nl/244811 (accessed on 15 October 2022).
68. Guiné, R.P.F.; Costa, C.A. Compliance of Agricultural Practices Used in Family Farms with Those Recommended in Organic Farming. *Open Agric.* **2018**, *3*, 368–377. [CrossRef]
69. Coelho, C. A Transição da Agricultura Familiar para Sistemas de Produção Mais Sustentáveis na Região Norte de Portugal. Master's Thesis, Instituto Politécnico de Viana do Castelo, Ponte de Lima, Portugal, 2024; 79p.
70. INE. *Recenseamento Agrícola. Análise dos Principais Resultados: 2019*; INE: Lisboa, Portugal, 2021; ISBN 978-989-25-0562-6. Available online: https://www.ine.pt/xurl/pub/437178558 (accessed on 15 October 2022).
71. Marino, D.; Curcio, F.; Felici, F.B.; Mazzocchi, G. Toward Evidence Based Local Food Policy: An Agroecological Assessment of Urban Agriculture in Rome. *Land* **2024**, *13*, 30. [CrossRef]
72. Steglich, M.; Beutler, T.; Kativu, S.N.; Favi, S.G.; Kawira, C.; Grasi, C.; Maalim, A.A.; Kallee, D.; Osho-Abdulgafar, N.F.; Kasali, O.I.; et al. *Agroecology and Rural Development: Acting in the Global North—With and for the Global South*; Centre for Rural Development: Berlin, Germany, 2020. [CrossRef]

Article 2 | Recognizing diversity to enable an agroecological transition: Understanding the potential of family farmers in Portugal

Costa-Pereira, I., Aguiar, A. A. R. M., Delgado, F., & Costa, C. A. (2025). Recognizing diversity to enable an agroecological transition: Understanding the potential of family farmers in Portugal. *Frontiers in Sustainable Food systems*, 9. https://doi.org/10.3389/fsufs.2025.1604961

Paper available online on July 15, 2025

Classification according to journal: original research article

Bibliometric indicators from Web of Science

Journal Impact Factor | 3.1

Ranking | 53,6%

Quartile | Q1

ANNEX 2 | Questionnaire based on the constructed methodology administered to farmers and the indicator grid

frontiers | Frontiers in Sustainable Food Systems

TYPE Original Research
PUBLISHED 15 July 2025
DOI 10.3389/fsufs.2025.1604961

OPEN ACCESS

EDITED BY
Liming Ye,
Ghent University, Belgium

REVIEWED BY
Gonzalo A. R. Molina,
Instituto Nacional de Tecnología Agropecuaria (INTA)-Instituto de Investigación y Desarrollo Tecnológico para la Agricultura Familiar (IPAF) Patagonia, Argentina
Sarah Milliken,
University of Greenwich, United Kingdom

*CORRESPONDENCE
Inês Costa-Pereira
inespereira@esav.ipv.pt

RECEIVED 02 April 2025
ACCEPTED 28 May 2025
PUBLISHED 15 July 2025

CITATION
Costa-Pereira I, Aguiar AARM, Delgado F and Costa CA (2025) Recognizing diversity to enable an agroecological transition: understanding the potential of family farmers in Portugal.
Front. Sustain. Food Syst. 9:1604961.
doi: 10.3389/fsufs.2025.1604961

Recognizing diversity to enable an agroecological transition: understanding the potential of family farmers in Portugal

Inês Costa-Pereira[1]*, Ana A. R. M. Aguiar[2], Fernanda Delgado[3] and Cristina A. Costa[1]

[1]Research Centre for Natural Resources, Environment and Society - CERNAS/IPV -Polytechnic Institute of Viseu, Viseu, Portugal, [2]GreenUPorto - Sustainable Agrifood Production Research Centre/ Inov4Agro, DGAOT, Faculty of Sciences University of Porto, Porto, Portugal, [3]Research Centre for Natural Resources, Environment and Society - CERNAS/IPCB-Polytechnic University of Castelo Branco, Castelo Branco, Portugal

The agroecological transition of family farms in Portugal poses a significant challenge within the framework of the Common Agricultural Policy (CAP) and the European Green Deal. Despite their multifunctional contributions to rural territories, family farms—particularly smallholders—remain structurally disadvantaged by policy frameworks that continue to favor large-scale, high-input agricultural models. This study demonstrates that aligning family farming with agroecological principles yields tangible benefits and requires support through differentiated, typology-sensitive public policies. Using a tailored methodology, data were collected from 40 farms initially classified as conventional or agroecological. Ward's hierarchical clustering, supported by complementary significance tests, identified three distinct farmer typologies: conventional, proto-agroecological, and agroecological. These typologies reflect meaningful differences in ecological integration, systemic thinking, and social engagement. The findings highlight the need for targeted policy frameworks that recognize farm diversity and promote multiple pathways toward agroecology. This typology-based approach provides an empirically grounded foundation for designing more inclusive and context-responsive institutional support for family farmers in Portugal.

KEYWORDS

agroecology, food systems, territorial governance, policy instruments, cluster analysis

1 Introduction

The agroecological transition of family farms in Portugal is a crucial challenge within the framework of the Common Agricultural Policy (CAP) and the European Green Deal in its Farm to Fork and Biodiversity Strategies. These EU instruments predominantly support large-scale, high-input farms, limiting family farms and smallholders' access to financial and technical resources for agroecological transitions (Gava et al., 2022; Linares Quero et al., 2022; Viegas et al., 2023; Dinis, 2024).

However, family farming remains central to agricultural production in capitalist economies, despite modernization policies that have prioritized efficiency and productivity (Dinis, 2019; Costa et al., 2022). Beyond production, these farms contribute to household food security, local knowledge preservation, and natural resource conservation, playing a multifunctional role within rural communities. Nonetheless, CAP's subsidy distribution disadvantages family farms and smallholders, restricting their ability to meet new sustainability

requirements while reinforcing structural inequalities that favor capital-intensive farming systems. Additionally, the implementation of Farm to Fork and Biodiversity Strategies does not fully account for the constraints faced by family farms, who often struggle with certification, regulatory compliance, and access to sustainability incentives (Prost et al., 2023; Huber et al., 2024). Larger and intensive farms, with greater financial stability and technical capacity, are better positioned to adapt, exacerbating disparities between industrialized and family farming models (Prost et al., 2023).

In Portugal, the Common Agricultural Policy (CAP) continues to inequitably support farms engaged in low-input, diversified agroecological practices—particularly those of smaller scale. Recent research shows that approximately 40% of Portuguese farmers receive no CAP support, with exclusion rates exceeding 60% for farms under two hectares (Viegas et al., 2023). Access to funding is further hindered by bureaucratic complexity, restrictive eligibility criteria, and limited administrative assistance. Meanwhile, subsidies remain heavily concentrated on large-scale, commodity-oriented farms. Mediterranean farming systems—such as orchards, olive groves, vineyards, and diversified horticulture—receive disproportionately less support compared to cereal and livestock operations, thereby discouraging transitions toward agroecology (Dinis, 2024).

Studies show that CAP Pillar I direct payments, particularly land-based subsidies, are among the least effective instruments for supporting agroecology, whereas CAP Pillar II measures, such as agri-environmental schemes, organic farming incentives, and support for short supply chains, demonstrate greater potential. However, these instruments are often underfunded and hindered by implementation challenges (Gava et al., 2022; Linares Quero et al., 2022).

A transition to agroecology among family farms requires policies that integrate farm, household, and community dynamics rather than relying on top-down modernization approaches (Costa et al., 2022). Recognizing the diverse pathways of agroecological transition—including traditional knowledge, local networks, and multifunctional rural roles—would allow for more tailored support mechanisms aligned with farmers' socio-economic and environmental contexts.

Despite the increasing recognition of farm diversity in policy research, many existing farmer classifications remain static, simplistic, and poorly integrated into CAP decision-making (Fanchone et al., 2020; Graskemper et al., 2021). Policies often neglect informal farmer networks, on-farm experimentation, and knowledge-sharing mechanisms, which are critical for agroecological transitions (Teixeira et al., 2018). Additionally, short-term policy assessments fail to account for the long-term nature of these transitions, leading to misaligned incentives and inadequate support (Prost et al., 2023).

Agroecology offers significant potential to strengthen the resilience and viability of family farms. As Costa et al. (2022) highlight, these farms are deeply rooted in traditional practices and play a multifunctional role in rural areas, yet they often face vulnerabilities due to limited technical support and exposure to environmental and health risks. Altieri (2009) and Altieri and Nicholls (2020) emphasizes that agroecological practices—grounded in ecological principles and traditional knowledge—can improve soil health, biodiversity, and productivity, resulting in more stable yields, diversified income, and improved nutritional outcomes. Bezner Kerr et al. (2021) support this perspective, noting that agroecology enhances food security and nutrition among smallholder households through direct consumption of diverse foods, increased agricultural income, and shifts in gender relations.

To develop more effective public policies that support agroecology, it is essential to characterize family farms by considering their structural characteristics, production models, market integration, and agricultural practices (Huber et al., 2024). This study seeks to demonstrate that aligning family farming with agroecological principles can generate meaningful benefits and that these synergies must be acknowledged and supported through differentiated, context-sensitive public policies. By identifying and characterizing farm types along a gradient of agroecological transition, it seeks to shed light on the diversity of pathways within family farming and to reinforce the need for policy strategies that address the specific needs, constraints, and contributions of these farmers.

2 Materials and methods

To demonstrate the benefits of aligning family farming with agroecological principles—and to underscore the need for tailored public policies that support such synergies—this study employed a methodological approach that integrates two analytical frameworks: the Tool for Agroecology Performance Evaluation (TAPE), developed by the Food and Agriculture Organization of the United Nations (FAO), and the Agroecological Criteria Tool (ACT), created by Biodivision (Costa-Pereira et al., 2024). This combined methodology was specifically designed to assess farmers' agroecological performance by measuring the adoption of core agroecological principles and practices, thereby providing a robust foundation for evidence-based policy recommendations.

2.1 Sample characteristics

The methodology was applied between October 2023 and January 2024 to a sample of 40 farms distributed across five NUTS II regions of continental Portugal—North, Center, Lisbon Metropolitan Area (AML), Alentejo, and Algarve—capturing the diversity of the country's agricultural landscapes and sociocultural contexts. The sample comprised 20 matched pairs of farms, each including one agroecological and one conventional farm, located within the same territorial area. The regional distribution was as follows: Norte ($n = 14$), Centro ($n = 6$), Lisbon Metropolitan Area—AML ($n = 8$), Alentejo ($n = 6$), and Algarve ($n = 6$; Figure 1). This paired and stratified sampling approach was intended to ensure comparability by minimizing variation in farm scale, crop types, local food system characteristics, and edaphoclimatic conditions.

Farms were selected according to three main criteria to ensure internal consistency. First, all farms engaged primarily in horticultural production—accompanied by other complementary agricultural activities—to maintain a consistent production focus. Second, agroecological farms were defined by the exclusion of synthetic inputs, such as fertilizers and pesticides. The non-use of synthetic fertilizers and pesticides was applied as an initial filter to identify farms potentially aligned with agroecological principles, within a broader, multidimensional framework that does not define agroecology solely through input-based criteria but rather seeks to capture systemic transitions.

10.3389/fsufs.2025.1604961

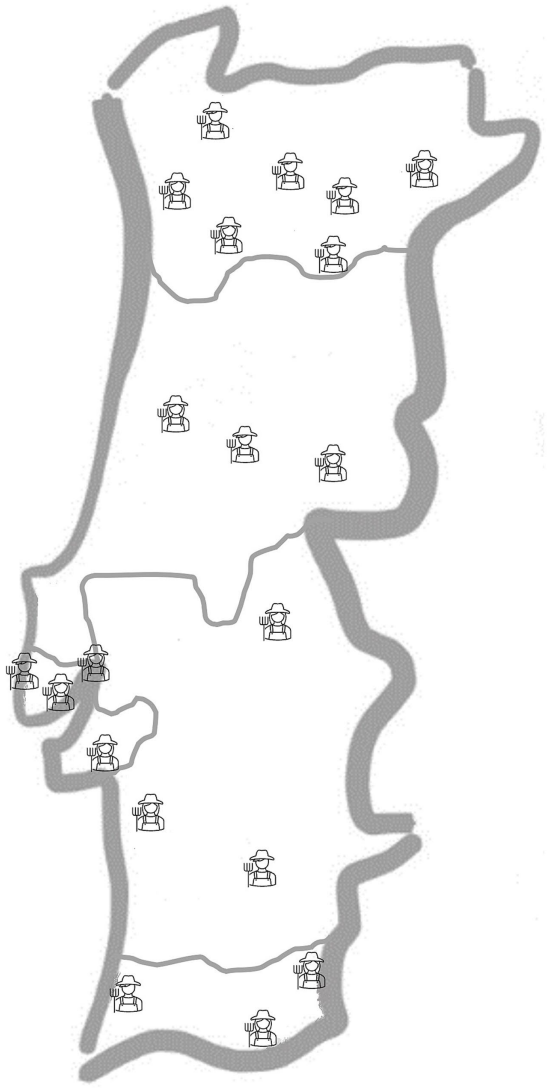


FIGURE 1
Location of the 40 farms visited (pairs of 20 agroecological/20 conventional) per NUTS II.

2.2 Data collection and analysis procedure

Data collection was carried out through field visits and semi-structured interviews using a standardized questionnaire, developed according to the methodology proposed by Costa-Pereira et al. (2024). Farmers' responses were codified in binary or scaled formats, depending on the variable type: binary variables were coded as 0 or 1, while scaled variables captured increasing levels of characteristics such as education level or household income.

Based on these responses, 26 indicators were constructed and scored on a scale from 0 to 4, with 0 indicating low performance and 4 indicating high agroecological performance (in Supplementary Materials). These indicators were grouped into 10 agroecological dimensions, encompassing both agroecosystem management and food system interactions. The eight dimensions related to the agroecosystem were: (1) plant production, (2) animal production, (3) soil regeneration, (4) water cycle regeneration, (5) pest, disease and weed management, (6) ecological synergies, (7) economic synergies, and (8) social synergies. The two dimensions relating to the local/global food system were: (9) interaction with the local food system, and (10) sharing agroecological knowledge.

Each dimension incorporated multiple indicators. For example, the soil regeneration dimension includes practices related to soil fertility management and soil–plant systems, while plant production includes seed management and the integration of trees into cropping systems. Economic synergies reflect internal input use, income stability, and renewable energy adoption. Ecological synergies assess the farm's integration with the surrounding landscape. Social synergies capture working conditions, gender and youth empowerment, and food security. The sharing of agroecological knowledge includes access to information, traditional know-how, and farmer-to-farmer knowledge exchange. This multidimensional structure allowed for a comprehensive and nuanced assessment of each farm's agroecological performance, serving as a basis for subsequent clustering and policy-relevant analysis (Table 1).

The methodology included a specific section on public policy preferences to identify the institutional levers that farmers perceive as most effective in supporting the agroecological transition. Farmers were asked to indicate their preferred types of policy measures across four categories: (1) regulatory measures, such as the prohibition or taxation of synthetic chemical pesticides; (2) certification controls to ensure credibility and accessibility of agroecological certification systems; (3) economic support, including subsidies and financial incentives tailored to agroecological farming; and (4) education and awareness-raising initiatives targeting farmers, consumers, and society more broadly.

The analytical process aimed to classify farms according to their level of agroecological adoption and identify key patterns of differentiation. For this purpose, hierarchical clustering was applied to the indicator matrix, using Euclidean distance to compute the distance matrix and Ward's method for linkage. Ward's method was selected for its ability to minimize within-cluster variance and enhance the interpretability of the resulting clusters (Johnson and Wichern, 2007).

To assess the robustness of the clustering solution, three additional approaches were tested. First, alternative hierarchical methods—centroid and complete linkage—were applied. Centroid linkage evaluates cluster similarity based on the distance between group means, while complete linkage calculates the maximum distance between observations across clusters, thereby reinforcing internal cohesion. Second, K-means clustering was conducted to minimize intra-cluster variability and explore potential alternative segmentations. This cross-validation framework allowed for the testing of consistency and stability in the cluster solution.

To validate and refine the clustering further, a sensitivity analysis was performed on the grouped questionnaire data. Each agroecological dimension was tested to evaluate its capacity to discriminate between clusters. Given the small sample size and the ordinal nature of much of the data, the non-parametric Kruskal–Wallis test was used to assess the statistical significance of differences across clusters. Following this, Principal Component Analysis (PCA) was conducted on each dimension to identify the most explanatory indicators contributing to overall variance and cluster differentiation (Peres-Neto et al., 2003). To deepen the analysis, individual significance tests were applied to the key

TABLE 1 Indicators distribution per agroecological dimension.

10. Agroecological dimension	26 Indicators
1. Plant production	1. Integration with trees
	2. Seed management
2. Animal production	3. Animal species management
	4. Animal welfare
3. Soil regeneration	5. Soil fertility management
	6. Soil–plant management system
4. Water cycle regeneration	7. Water saving
5. Pest, disease and weed management	8. Pest and disease management
	9. Registration of production and pests, diseases and weeds
6. Ecological synergies	10. Integration: crops/animals
	11. Connectivity between elements of the agroecosystem and the landscape
	12. Biodiversity
	13. Biomass and non-biomass recycling
7. Economic synergies	14. Energy production and renewal
	15. Use of internal inputs
	16. Diversity of production activities and services
	17. Stability of income/production and ability to recover from disturbances/environmental resilience and ability to adapt to climate change
8. Social synergies	18. Production and household needs/ adequate food and nutritional awareness
	19. Dignification of farmers/working conditions
	20. Women's empowerment
	21. Youth empowerment and emigration
9. Interactions with the Local Food System	22. Producer networks, consumer relations and presence of intermediaries
	23. Empowerment of producers/mechanisms to reduce vulnerability/Participation of producers in the governance of land and natural resources
	24. Relations with the community
10. Sharing agroecological knowledge	25. Local or traditional identity and awareness: includes traditional knowledge for food preparation
	26. Access to agroecological knowledge and producers' interest in agroecology.

variables identified through PCA within each dimension. These results were examined alongside the indicator-level scores to enrich the interpretation of intra- and inter-cluster similarities and differences.

To ensure statistical rigor in profiling the identified clusters, assumptions of normality and homogeneity of variance for multidimensional scaling (MDS) scores were first tested. Depending on the distributional properties, either parametric (ANOVA) or non-parametric (Kruskal–Wallis) tests were performed. All statistical analyses were carried out using IBM SPSS Statistics software (version 29), with a significance level set at 5% ($p < 0.05$).

3 Results

The average farm size across all regions was approximately 9 hectares and the average age of farmers ranged from 50.3 years in Alentejo to 57.5 years in Centro. Education levels also varied, with Norte displaying the highest average level (equivalent to a licentiate degree), and AML the lowest (typically professional training or secondary education). Farming experience, measured by the number of years engaged in agricultural activity, varied widely across the sample. Farmers in AML reported the highest average years of experience (35 years), while Alentejo reported the lowest average (12 years). Taken together, these variables provide important contextual insight into the demographic and structural profile of the sampled farms, which may influence the capacity to adopt agroecological practices (Table 2).

3.1 Indicators matrix analysis

Three clusters of farmers were identified based on their performance across the 26 agroecological indicators. To characterize the clusters, the mean and standard deviation of each of the 26 agroecological indicators were calculated, followed by the application of mean comparison tests to assess statistically significant differences among clusters. This analysis enabled the identification of patterns across clusters and the detection of indicators that contributed most to their differentiation (Table 3).

The analysis of the 26 agroecological indicators across the three clusters revealed statistically significant differences for the vast

TABLE 2 Sociodemographic characteristics of the farms by NUTS II region.

Region	Number of farms	Avg. farm area (ha)	Avg. age	Avg. education level (1–8)	Avg. years as farmer
Norte	14	9.80	50.8	4.71	23.4
Centro	6	6.50	57.5	4.17	33.8
AMLisboa	8	6.60	57.0	4.00	35.0
Alentejo	6	6.52	50.3	4.33	12.0
Algarve	6	15.47	51.8	4.50	29.7

majority of variables, highlighting the heterogeneity in agroecological practice adoption among the sampled farms. Only three indicators—*youth empowerment and emigration, producer networks and consumer relations, and relations with the community*—did not show statistically significant variation across clusters. These dimensions, which are more closely linked to broader social dynamics and community-level interactions, appear to be less sensitive to the structural and operational differences captured through the clustering process, or may require larger sample sizes to detect significant variation.

Among the indicators that did differentiate the clusters, *integration with trees, water saving, and biodiversity* presented significant variation across all three clusters. These practices are central to ecological design and conservation, offering critical insight into the extent and nature of the agroecological transition processes underway on these farms.

Cluster 2 consistently achieved the highest scores across most indicators, reflecting a strong commitment to integrated, diversified, and ecologically grounded farming systems. Farmers in this cluster demonstrated widespread adoption of agroecological management practices, particularly in areas such as *seed systems, pest and disease control, energy use, income stability, and biodiversity enhancement*. This group also reported higher levels of social and institutional engagement, with especially strong scores in indicators related to *working conditions, gender equity, and traditional knowledge.* The overall profile of Cluster 2 represents farms that are not only adopting agroecological practices but are also consolidating their ecological and social strategies within a broader systems-based approach.

In contrast, **Cluster 3** presented the lowest mean scores across most agroecological dimensions. This group lagged particularly in key indicators such as *biodiversity, water saving, integration with trees, and pest and disease management,* signaling narrow ecological integration. Nevertheless, Cluster 3 exhibited notable similarities with Cluster 1 in several areas, including *animal species management, animal welfare, integration of crops and animals, use of internal inputs, and diversity of production activities and services.* In the domain of social synergies—especially *production and household needs, working conditions, women's empowerment, and traditional knowledge*—Cluster 3 also aligns closely with Cluster 1. These findings suggest that, despite more limited ecological integration, the two clusters exhibit relatively similar profiles in the social domain.

Cluster 1 occupies an intermediate or transitional position between Clusters 2 and 3, with moderate scores across most indicators. It demonstrated strong performance in indicators as *soil fertility management, soil–plant management, landscape connectivity, and biomass recycling*, showing close alignment with Cluster 2 in these areas. However, in other indicators—such as *animal integration, production diversity, and social empowerment*—Cluster 1 is closer to Cluster 3. This dual alignment positions Cluster 1 as a strategic leverage point for transition: these farms may already have a foundation of practices and knowledge that, with targeted support, could be deepened into more integrated agroecological systems.

In sum, the clustering analysis identified three distinct yet interrelated profiles that do not represent a linear hierarchy but rather diverse expressions of agroecological engagement. The most significant contrasts were observed between Clusters 2 and 3, where differences in several key indicators exceeded two points. These findings underscore the diversity of agroecological strategies among family farms in Portugal and highlight the importance of differentiated, typology-sensitive approaches to support the agroecological transition.

3.2 Understanding differences and similarities among farmers

To further investigate which variables contributed most to cluster differentiation, sociodemographic, technical, and economic characteristics—organized according the 10 agroecological dimensions—are presented and used to compare the three identified clusters. This information was collected through the questions answered by the farmers during the survey (Table 4).

Based on the indicators and characteristics of the farmers included in each cluster, it is possible to define them as agroecological (Cluster 2), proto-agroecological (Cluster 1) and conventional (Cluster 3) farmers. These typologies are not merely statistical groupings, but reflect meaningful patterns in farming strategies, social organization, ecological integration, and cultural identity.

3.3 Agroecological farmers

The agroecological farmers, represented by Cluster 2, are the most advanced in terms of agroecological integration and systemic thinking. These farmers are also relatively young, with an average age of 49, and report high levels of formal education, often at the university level. With an average of 16 years of experience, they demonstrate a coherent and deliberate adoption of agroecological principles across multiple dimensions. Their practices include the use of trees for both soil fertility enhancement and erosion prevention, biological pest control methods such as the use of ladybirds and multifunctional plants, and the complete exclusion of synthetic pesticides. Farms in this cluster tend to incorporate structured ecological elements, including flower strips and stone walls, to support biodiversity, although some features like nesting sites for birds and bats remain underutilized. These farmers also engage in composting and renewable energy production, with many partially

TABLE 3 Mean values and standard deviations of the 26 agroecological indicators by cluster, along with the results of significance tests.

10 Agroecological dimensions	26 Indicators	Cluster 1 (mean ± standard deviation)				Cluster 2 (mean ± standard deviation)				Cluster 3 (mean ± standard deviation)				Sig.
1. Plant production	1. Integration with trees	**2,50**	±	**1,05**	**a**	**3,65**	±	**0,61**	**b**	**1,06**	±	**0,83**	**c**	**0,000**
	2. Seed management	1,50	±	1,52		**2,18**	±	**0,64**	**a**	**0,94**	±	**0,43**	**b**	**0,000**
2. Animal production	3. Animal species management	0,50	±	0,55	a	**2,18**	±	**0,95**	**b**	0,76	±	0,56	a	**0,000**
	4. Animal welfare	1,83	±	1,47	a	**3,65**	±	**1,00**	**b**	1,53	±	1,07	a	**0,000**
3. Soil regeneration	5. Soil fertility management	3,17	±	1,17	a	4,00	±	0,00	a	**0,88**	±	**0,33**	**b**	**0,000**
	6. Soil–plant management system	2,83	±	0,98	a	4,00	±	0,00	a	**0,76**	±	**0,66**	**b**	**0,000**
4. Water cycle regeneration	7. Water saving	**2,33**	±	**1,03**	**a**	**3,65**	±	**0,61**	**b**	**1,29**	±	**0,99**	**c**	**0,000**
5. Pest, disease and weed management	8. Pest and disease management	2,17	±	1,47		**4,00**	±	**0,00**	**a**	**0,12**	±	**0,33**	**b**	**0,000**
	9. Registration of production and pests, diseases and weeds	1,33	±	1,75		**2,41**	±	**1,33**	**a**	**0,29**	±	**0,47**	**b**	**0,000**
6. Ecological synergies	10. Integration: crops/animals	0,83	±	0,75	a	**3,18**	±	**1,07**	**b**	1,06	±	0,83	a	**0,000**
	11. Connectivity between elements of the agroecosystem and the landscape	2,67	±	1,21	a	3,82	±	0,53	a	**0,59**	±	**0,51**	**b**	**0,000**
	12. Biodiversity	**2,33**	±	**1,03**	**a**	**3,82**	±	**0,53**	**b**	**0,65**	±	**0,61**	**c**	**0,000**
	13. Biomass and non-biomass recycling	3,00	±	0,89	a	3,97	±	0,12	a	**1,00**	±	**0,87**	**b**	**0,000**
7. Economic synergies	14. Energy production and renewal	1,00	±	0,89		**1,59**	±	**1,06**	**a**	**0,59**	±	**0,62**	**b**	**0,016**
	15. Use of internal inputs	1,33	±	0,52	a	**3,06**	±	**0,83**	**b**	1,06	±	0,43	a	**0,000**
	16. Diversity of production activities and services	**2,33**	±	**0,82**	**a**	**3,94**	±	**0,24**	**b**	**1,41**	±	**1,00**	**a**	**0,000**
	17. Stability of income/production and ability to recover from disturbances	2,17	±	0,98		**2,88**	±	**1,05**	**a**	**1,65**	±	**0,86**	**b**	**0,004**
8. Social synergies	18. Production and household needs/ adequate food and nutritional awareness	2,00	±	1,26	a	**3,06**	±	**0,97**	**b**	1,59	±	0,71	a	**0,001**
	19. Dignification of farmers/working conditions	2,17	±	1,33	a	**3,47**	±	**0,72**	**b**	1,29	±	1,05	a	**0,000**
	20. Women's empowerment	2,50	±	0,84	a	**3,65**	±	**1,06**	**b**	1,94	±	1,30	a	**0,000**
	21. Youth empowerment and emigration	1,17	±	0,75		2,24	±	1,60		1,18	±	0,88		0,091
9. Interactions with the Local Food System	22. Producer networks, consumer relations and presence of intermediaries	2,83	±	1,47		**3,59**	±	**0,80**	**a**	**2,41**	±	**1,28**	**b**	**0,004**
	23. Empowerment of producers/mechanisms to reduce vulnerability/ governance participation of producers	1,00	±	0,63		1,65	±	1,22		0,94	±	0,83		0,110
	24. Relations with the community	2,67	±	1,51		3,24	±	1,09		2,82	±	1,13		0,408
10. Sharing agroecological knowledge	25. Local or traditional identity and awareness	2,17	±	0,98	a	**3,35**	±	**0,70**	**b**	2,12	±	0,78	a	**0,000**
	26. Access to agroecological knowledge and producers interest in agroecology.	1,67	±	1,63		**3,94**	±	**0,24**	**a**	**0,06**	±	**0,24**	**b**	**0,000**

Values with different superscript letters indicate statistically significant differences between clusters at the 5% significance level ($p < 0.05$) are highlighted in gray.

10.3389/fsufs.2025.1604961

supplying their own energy needs through solar panels. Socially, they are highly engaged and score significantly higher in indicators related to gender equity, with women frequently involved in decisions regarding animal production, economic activities, and major household assets. Economically, this group shows greater diversification of income sources and improved access to credit. Their practices align with the concept of "transformative agroecology" as described by Altieri and Nicholls (2020), in which farms function as ecologically embedded, socially empowered, and territorially anchored systems. These farmers exemplify a comprehensive, integrated model of agroecological farming that extends beyond agronomic practices to encompass cultural identity, political engagement, and systemic resilience.

3.4 Conventional farmers

The conventional farmers, represented by Cluster 3, are the most experienced group in the sample, with an average of 40 years of farming activity. They are generally older (average age of 59) and tend to have lower levels of formal education, typically having completed secondary education or less. Their farming systems are rooted in long-standing practices and intergenerational knowledge, reflecting deep familiarity with local crops and livestock conditions. While these farmers continue to rely on conventional practices, particularly the use of synthetic herbicides and animal-origin fertilizers, they play an essential role in the rural economy. Their agricultural approach is shaped by practical experience and continuity, often emphasizing productivity and land stewardship in the face of changing policy and market dynamics. As highlighted by Fonseca et al. (2024) and Williamson et al. (2024), these systems face significant ecological challenges, including soil degradation and biodiversity loss, which may compromise long-term resilience. With appropriate incentives and peer-based learning opportunities, conventional farmers could gradually adopt low-input or regenerative practices, paving the way for partial transitions.

3.5 Proto-agroecological farmers

The proto-agroecological farmers, represented by Cluster 1, occupy a transitional position between conventional and agroecological systems. They are generally younger, with an average age of 49, and possess relatively high levels of formal education, including a high proportion with university degrees. With an average of 20 years of farming experience, they blend conventional and agroecological practices. Their scores are intermediate across most agroecological dimensions, but they align more closely with agroecological farmers in practices such as intercropping, soil fertility management—including the use of trees for soil fertility—landscape connectivity, and biomass recycling. Although ecological synergies are present, these are often underdeveloped or unstructured, with limited use of features such as stone shelters or flower strips. Their waste management practices and approaches to animal sourcing also differ significantly from both of the other groups. As such, proto-agroecological farmers demonstrate partial ecological integration and growing engagement with agroecological principles but have yet to adopt a fully systemic approach. Their position within the agroecological transition continuum suggests strong potential for advancement, especially with appropriate institutional support and targeted technical assistance. As described by Horstink et al. (2023), Matthews (2022) and van der Ploeg et al. (2019), this group fits the definition of "proto-agroecological"—systems that are moving toward agroecology through incremental practice adoption, innovation, and community engagement. Overall, this group consists of experienced and technically informed farmers who balance conventional and agroecological practices but have yet to fully engage in structured agroecological approaches.

3.6 Addressing public policies

In relation to public policy preferences, four questions were included in the survey to assess farmers' perspectives on institutional measures to support agroecological transitions. Among these, statistically significant differences between clusters emerged only for support for regulatory measures aimed at restricting harmful inputs, such as synthetic pesticides, including, for example, the creation of taxes on the application of synthetic pesticides. This preference was particularly prominent among agroecological farmers, although it was also mentioned by farmers in the proto-agroecological and conventional clusters, indicating a broader awareness of the environmental impacts of input-intensive practices.

While the other policy-related questions did not show statistically significant differences between clusters, several of these variables were retained in the PCA and offer relevant insights for policy design. Notably, financial support through subsidies was mentioned across all groups. However, some farmers expressed concerns about subsidy dependence, highlighting the need for support structures that promote autonomy and resilience. In addition, several respondents emphasized the importance of continuous and accessible technical assistance, particularly through public extension services or similar advisory mechanisms. The need for improved transparency and enforcement in agroecological certification processes was also raised, underscoring the relevance of effective oversight in building trust and credibility in certification processes.

4 Discussion/conclusion

This study applied an integrated, data-driven methodology to identify key differentiating indicators and characteristics among family farms in Portugal, enabling the development of a typology-based framework for supporting agroecological transitions. By distinguishing three distinct farmer typologies—conventional, proto-agroecological, and agroecological—the analysis highlights the diverse capacities, strategies, and sociocultural orientations shaping agroecological engagement across rural territories.

These typologies are not fixed categories but represent dynamic positions along a continuum of transformation. Each group plays a distinct and strategic role in promoting a more socially just and ecologically resilient agri-food system.

Agroecological farmers constitute the most advanced typology in terms of ecological integration, systemic thinking, and community involvement. Agroecological farmers emphasize the importance of

TABLE 4 Results of the significance tests applied to the three clusters, including mean values, standard deviations, and *p*-values.

10 Agroecological dimensions	Variables /questions	Cluster 1 (mean ± standard deviation)				Cluster 2 (mean ± standard deviation)				Cluster 3 (mean ± standard deviation)				Sig.
Sociodemographic characteristics	Education: 1 CEB to Doctorate	5,17	±	2,04		**5,82**	±	**0,53**	**a**	**2,71**	±	**1,36**	**b**	**0,000**
	Years been a farmer	20,17	±	1,26	a	15,76	±	0,78	a	**39,47**	±	**1,41**	**b**	**0,013**
	Employment/occupation situation: self-employed with or without employees to retired or unemployed	3,67	±	1,21		**4,00**	±	**1,06**	**a**	**2,76**	±	**1,44**	**b**	**0,045**
	Age	49,00	±	0,41		**49,12**	±	**0,73**	**a**	**58,59**	±	**0,62**	**b**	**0,048**
	Other professions: did not have/ had connected to the food system	0,83	±	0,75		1,06	±	0,56		0,71	±	0,69		0,253
Dimension 1. Plant Production	Production System (conventional, integrated production, organic, biodynamic, regenerative, other)	**0,50**	±	**0,55**	**a**	**1,00**	±	**0,00**	**b**	**0,00**	±	**0,00**	**c**	**0,000**
	Do intercropping	**0,50**	±	**0,55**	**a**	**1,00**	±	**0,00**	**b**	**0,00**	±	**0,00**	**c**	**0,000**
	Use crop diversity between rows	0,67	±	0,52		1,00	±	0,00			±	0,00		**0,000**
	Trees used to increase soil fertility	**0,17**	±	**0,41**	**a**	**1,00**	±	**0,00**	**b**	**0,06**	±	**0,24**	**c**	**0,000**
	Trees used as a barrier to soil erosion	0,33	±	0,52		**0,94**	±	**0,24**	**a**	**0,00**	±	**0,00**	**b**	**0,000**
Dimension 2. Animal production	Meat production	0,67	±	0,52		**0,41**	±	**0,51**	**a**	**0,88**	±	**0,33**	**b**	**0,014**
	Place where you buy the animals	**0,50**	±	**0,55**	**a**	**1,82**	±	**1,29**	**b**	0,88	±	0,99		**0,016**
	Use of antibiotics	2,33	±	1,86		**3,76**	±	**0,97**	**a**	**2,82**	±	**1,13**	**b**	**0,003**
Dimension 3. Soil regeneration	Fertilizers of animal origin are the most frequently used	0,17	±	0,41	a	0,00	±	0,00	a	**0,94**	±	**0,24**	**b**	**0,000**
	Fertilizers of mineral origin are the most frequently used	0,83	±	0,41	a	0,94	±	0,24	a	**0,12**	±	**0,33**	**b**	**0,000**
	Other soil conservation practices	1,83	±	1,17	a	1,82	±	0,88	a	**0,12**	±	**0,33**	**b**	**0,000**
	After harvesting the crops soil usually remains cover/not cover	2,33	±	1,86		**3,53**	±	**1,33**	**a**	**0,29**	±	**0,59**	**b**	**0,000**
	The farmer parents/grandparents have used manure on the farm	0,33	±	0,52		**0,53**	±	**0,51**	**a**	**1,00**	±	**0,00**	**b**	**0,001**
Dimension 4. Water cycle regeneration	Water used for farming comes from a pond	0,50	±	0,55		**0,41**	±	**0,51**	**a**	**0,06**	±	**0,24**	**b**	**0,031**
	Preserve water in a pond	0,67	±	0,52		0,47	±	0,51		0,12	±	0,33		**0,018**
Dimension 5. Pest and disease management	Use of synthetic fungicide	0,33	±	0,52			±	0,00		1,00	±	0,00		**0,000**
	Use of synthetic insecticides	0,50	±	0,55		0,00	±	0,00		1,00	±	0,00		**0,000**
	Use of synthetic herbicides	0,33	±	0,52		**0,00**	±	**0,00**	**a**	**0,88**	±	**0,33**	**b**	**0,000**
	Biological control with multifunctional plants	0,33	±	0,52		1,00	±	0,00			±	0,00		**0,000**
	Biological protection promote natural enemies	0,50	±	0,55		**0,88**	±	**0,33**	**a**	**0,00**	±	**0,00**	**b**	**0,000**
Dimension 6. Ecological synergies	There are some spaces for functional biodiversity, but they are not very well structured	1,50	±	0,84	a	2,00	±	0,87	a	**0,59**	±	**0,51**	**b**	**0,000**
	Islands or strips of flowers	0,33	±	0,52		**0,76**	±	**0,44**	**a**	**0,00**	±	**0,00**	**b**	**0,000**
	Stone shelters	1,00	±	0,00	a	0,71	±	0,47	a	**0,29**	±	**0,47**	**b**	**0,004**

(Continued)

10.3389/fsufs.2025.1604961

TABLE 4 (Continued)

10 Agroecological dimensions	Variables /questions	Cluster 1 (mean ± standard deviation)				Cluster 2 (mean ± standard deviation)				Cluster 3 (mean ± standard deviation)				Sig.
Dimension 7. Economic synergies production factors	Produce their composting	0,50	±	0,55		**0,88**	±	**0,33**	**a**	**0,12**	±	**0,33**	**b**	**0,000**
	Quantity of utilized energy purchased	1,17	±	0,75		**1,59**	±	**1,12**	**a**	**0,59**	±	**0,62**	**b**	**0,008**
	Destination of non-organic waste	2,83	±	0,41	a	3,00	±	0,00	a	**1,53**	±	**0,80**	**b**	**0,000**
	Consider composting in agricultural environments important	0,83	±	0,41		**1,00**	±	**0,00**	**a**	**0,29**	±	**0,47**	**b**	**0,000**
Dimension 7. Economic synergies farm characterisation	It's easy to get credit if needed	0,33	±	0,52		**0,59**	±	**0,51**	**a**	**0,18**	±	**0,39**	**b**	**0,044**
	Having access to credit	0,33	±	0,52		**0,59**	±	**0,51**	**a**	**0,18**	±	**0,39**	**b**	**0,044**
Dimension 7. Economic synergies farmers' incomes	The majority of the household's income comes from other internal sources	0,17	±	0,41		**1,59**	±	**1,73**	**a**	**0,29**	±	**1,21**	**b**	**0,019**
Dimension 8. Social synergies gender equality	Women usually make the decisions about animal production	0,33	±	0,52		**0,76**	±	**0,44**	**a**	**0,35**	±	**0,49**	**b**	**0,032**
	Women own the resources for other economic activities within the holding	0,33	±	0,52		**0,76**	±	**0,44**	**a**	**0,35**	±	**0,49**	**b**	**0,032**
	Women usually make the decisions about the other economic activities of the holding	0,33	±	0,52		**0,76**	±	**0,44**	**a**	**0,35**	±	**0,49**	**b**	**0,032**
	Women own most of the family's main assets	0,33	±	0,52		**0,76**	±	**0,44**	**a**	**0,35**	±	**0,49**	**b**	**0,032**
	Women usually make the decisions about the main assets of the family	0,33	±	0,52		**0,76**	±	**0,44**	**a**	**0,35**	±	**0,49**	**b**	**0,032**
Dimension 8. Social synergies equity for women	If they wanted to, women think they could make decisions about major farm expense	1,33	±	1,63		**1,71**	±	**1,90**	**a**	**3,00**	±	**1,73**	**b**	**0,040**
Dimension 10. Sharing agroecological knowledge	Habit of sharing knowledge with other farmers	1,83	±	1,47		**2,82**	±	**0,73**	**a**	**1,71**	±	**1,21**	**b**	**0,004**
	Have an idea of what agroecology is and often share knowledge on the subject	0,67	±	1,03		**1,88**	±	**0,33**	**a**	**0,00**	±	**0,00**	**b**	**0,000**
Public Policy	Ban/tax on the use of chemically synthesized pesticides	1,83	±	2,48		**3,29**	±	**1,93**	**a**	**0,76**	±	**1,48**	**b**	**0,005**

Statistically significant differences ($p < 0.05$) are highlighted in gray. Values with different superscript letters indicate significant differences between clusters at the 5% significance level.

10.3389/fsufs.2025.1604961

regulatory measures, particularly restrictions on synthetic pesticide use, as well as recognition and stable institutional support. Public policy can enhance their contributions by designating them as reference farms, ensuring procurement frameworks that prioritize agroecological products, and investing in territorial governance structures that embed agroecology into local planning, extension services, and education systems.

Conventional farmers, while the least aligned with agroecological practices, remain a foundational part of rural economies. They are deeply connected to their land, embedded in intergenerational knowledge systems, and well-integrated in local community life. For this group, the transition could be facilitated through targeted awareness-raising programs, demonstration farms, and incentive schemes that reward incremental changes such as cover cropping, composting, and reduced chemical input use. The implementation of peer-to-peer mentoring and locally contextualized training, delivered through trusted rural institutions, would be essential to enabling this gradual changes.

Proto-agroecological farmers emerge as a critical intermediary group—technically competent, ecologically aware, and socially embedded. While they have begun integrating agroecological principles, they remain partially dependent on conventional inputs. Their potential as catalysts of local transition underscores the importance of policy measures that support experimentation, capacity-building, and access to land and credit.

These findings highlight the importance of interpreting agroecological transitions not only through observable practices or demographic profiles, but also through the lens of broader structural conditions. As Hinrichs (2014) observes, transitions to sustainability may unfold in very different ways depending on farmers' initial access to resources, infrastructure, land, and economic stability. Even when farmers appear demographically similar, their trajectories can diverge substantially due to contextual factors that shape their capacity to engage with agroecological principles. Recognizing this diversity is crucial for designing support mechanisms and public policies that are sensitive to the differentiated realities of family farmers.

The study's findings stress that an effective agroecological transition cannot be achieved through uniform or top-down policy frameworks. Instead, it requires a multi-pathway strategy that recognizes the heterogeneity of farming systems and provides flexible, context-responsive support. Avoiding binary classifications between "good" and "bad" farmers, public policy should foster inclusive learning ecosystems, adaptive instruments, and participatory governance structures. Importantly, agroecology is not only a technical or environmental shift—it is also a cultural and social process. Recognizing farmers as co-creators of knowledge and territorial sustainability is fundamental to achieving systemic change.

In this context, a reorientation of the Common Agricultural Policy (CAP) is urgently needed, particularly in Southern Europe. Echoing van der Ploeg et al. (2019), the study supports redirecting CAP funding toward agroecological practices that enhance food quality, ecosystem services, employment, and territorial cohesion. Transitioning from scale-based to function-based subsidies would strengthen the ecological and social performance of family farming systems.

A key limitation of this study is its relatively small sample size ($n = 40$), which, while suitable for exploratory cluster analysis, may not fully capture the diversity of family farming across Portugal. Consequently, the findings should be interpreted with caution regarding broad generalization. Future research involving larger and more geographically diverse samples is essential to validate and expand these typologies and to inform more robust and evidence-based agroecological policies.

Data availability statement

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

Author contributions

IC-P: Writing – original draft, Conceptualization, Formal analysis, Investigation, Methodology. AA: Supervision, Writing – review & editing. FD: Supervision, Writing – review & editing. CC: Conceptualization, Methodology, Supervision, Validation, Writing – review & editing, Formal analysis.

Funding

The author(s) declare that financial support was received for the research and/or publication of this article. This research was funded by National Funds through the FCT-Foundation for Science and Technology, IC-P, within the scope of the individual doctoral research grant reference UI/BD/153087/2022.

Acknowledgments

The authors thank the Portuguese Foundation for Science and Technology (FCT) for the financial support to the Research Centre for Natural Resources, Environment and Society — CERNAS (UIDB/00681) and GreenUPorto, supported by national funds via FCT under the Strategic Projects UIDB/05748/2020 and UIDP/05748/2020 (doi: 10.54499/UIDB/05748/2020 and doi: 10.54499/UIDP/05748/2020). We are also grateful to the GrowLIFE project (Grant Agreement No. 101074425, LIFE21-GIC-PT-GrowLIFE) for the opportunity to apply the methodology as part of its Work Package: Participatory Visits to Sustainable Farms, and to the PAGE Project (Ref: RR-C05-i03-I-000217) for the opportunity to implement the methodology within the scope of its initiatives.

Conflict of interest

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

Generative AI statement

The author(s) declare that no Gen AI was used in the creation of this manuscript.

Publisher's note

References

Altieri, M. A. (2009). Agroecology, small farms, and food sovereignty. *Mon. Rev.* 61:5. doi: 10.14452/MR-061-03-2009-07_8

Altieri, M. A., and Nicholls, C. I. (2020). Agroecology: challenges and opportunities for farming in the Anthropocene. *Int. J. Agric. Nat. Resour.* 47, 204–215. doi: 10.7764/ijanr.v47i3.2281

Bezner Kerr, R., Madsen, S., Stüber, M., Liebert, J., Enloe, S., Borghino, N., et al. (2021). Can agroecology improve food security and nutrition? A review. *Glob. Food Secur.* 29:100540. doi: 10.1016/j.gfs.2021.100540

Costa, C. A., Aguiar, A., Parente, A., Neto, J., Valério, E., Godinho, M. C., et al. (2022). Innovation in small-farm agriculture in transition toward agroecology among family farmers: crop protection practices. US: CRC Press, 139–149.

Costa-Pereira, I., Aguiar, A. A. R. M., Delgado, F., and Costa, C. A. (2024). A methodological framework for assessing the agroecological performance of farms in Portugal: integrating TAPE and ACT approaches. *Sustain. For.* 16:3955. doi: 10.3390/su16103955

Dinis, I. (2019). The concept of family farming in the Portuguese political discourse. *Sociol. Sci.* 8:213. doi: 10.3390/socsci8070213

Dinis, I. (2024). Examining disparities in common agricultural policy direct payments among farming systems: evidence from Portugal. *Agric. Econ.* 12:5. doi: 10.1186/s40100-024-00299-6

Fanchone, A., Alexandre, G., Chia, E., Ozier-Lafontaine, H., and Angeon, V. (2020). A typology to understand the diversity of strategies of implementation of agroecological practices in the French West Indies. *Eur. J. Agron.* 117:126058. doi: 10.1016/j.eja.2020.126058

Fonseca, A. F., Polita, F., and Madureira, L. (2024). How agroecological transition frameworks are reshaping agroecology: a review. *Landscape* 13:1930. doi: 10.3390/land13111930

Gava, O., Povellato, A., and Linares Quero, A. (2022). Policy instruments to support agroecological transitions in Europe. *EuroChoices* 21, 13–20. doi: 10.1111/1746-692X.12367

Graskemper, V., Yu, X., and Feil, J. H. (2021). Farmer typology and implications for policy design – an unsupervised machine learning approach. *Land Use Policy* 103:105328. doi: 10.1016/j.landusepol.2021.105328

Hinrichs, C. C. (2014). Transitions to sustainability: a change in thinking about food systems change? *Agric. Hum. Values* 31, 143–155. doi: 10.1007/s10460-014-9479-5

Horstink, L., Encarnação, M., and Schwemmlein, K. (2023). Diagnóstico Rural Participativo –Odemira: Análise da realidade agroalimentar em Odemira | 2022 [relatório], ULisboa, ICS, GAIA. Available online at: https://repositorio.ulisboa.pt/bitstream/10451/55261/1/ICS_LHorstink_RelatorioOdemira.pdf (Accessed January 14, 2025).

Huber, R., Bartkowski, B., Brown, C., El Benni, N., Feil, J.-H., Grohmann, P., et al. (2024). Farm typologies for understanding farm systems and improving agricultural policy. *Agric. Syst.* 213:103800. doi: 10.1016/j.agsy.2023.103800

Johnson, R. A., and Wichern, D. W. (2007). Applied multivariate statistical analysis. Upper Saddle River, New Jersey, USA: Prentice Hall; Pearson Education Limited.

Linares Quero, A., Iragui Yoldi, U., Gava, O., Schwarz, G., Povellato, A., and Astrain, C. (2022). Assessment of the common agricultural policy 2014–2020 in supporting agroecological transitions: a comparative study of 15 cases across Europe. *Sustain. For.* 14:9261. doi: 10.3390/su14159261

Matthews, A. (2022). Prospects for agroecology in Europe. *EuroChoices* 21, 80–83. doi: 10.1111/1746-692X.12376

Peres-Neto, P. R., Jackson, D. A. J., and Somers, K. M. (2003). Giving meaningful interpretation to ordination axes: assessing loading significance in principal component analysis. *Ecology* 84, 2347–2236. doi: 10.1890/00-0634

Prost, L., Martin, G., Ballot, R., Benoit, M., Bergez, J.-E., Bockstaller, C., et al. (2023). Key research challenges to supporting farm transitions to agroecology in advanced economies: a review. *Agron. Sustain. Dev.* 43:11. doi: 10.1007/s13593-022-00855-8

Teixeira, H. M., Van den Berg, L., Cardoso, I. M., Vermue, A. J., Bianchi, F. J. J. A., Peña-Claros, M., et al. (2018). Understanding farm diversity to promote agroecological transitions. *Sustain. For.* 10:4337. doi: 10.3390/su10124337

Van der Ploeg, J. D., Barjolle, D., Bruil, J., Brunori, G., Madureira, L. M. C., Dessein, J., et al. (2019). The economic potential of agroecology: empirical evidence from Europe. *J. Rural. Stud.* 71:13–14. doi: 10.1016/j.jrurstud.2019.09.003

Viegas, M., Wolf, J., and Cordovil, F. (2023). Assessment of inequality in the common agricultural policy in Portugal. *Agric. Econ.* 11:13. doi: 10.1186/s40100-023-00255-w

Williamson, R. F., Reay, M., and Sgouridis, F. (2024). Permaculture management of arable soil increases soil microbial abundance, nutrients, and carbon stocks compared to conventional agriculture. *Agronomy* 14:1446. doi: 10.3390/agronomy14071446

Article 3 | Agroecology in Public Policies in Mediterranean Europe: a comparative analysis to inform the Portuguese context

Costa Pereira, I., Costa, C.A, & Delgado, C. Agroecology in Public Policies in Mediterranean Europe: a comparative analysis to inform the Portuguese context. Submitted (not yet published).

Agroecology in Public Policies in Mediterranean Europe: a comparative analysis to inform the Portuguese context

Costa-Pereira, I.[1;2]., Costa, C. A[1]; Delgado, C[3].

[1]Research Centre for Natural Resources, Environment and Society - CERNAS/IPV - Polytechnic Institute of Viseu, Viseu, Portugal.

[2]GreenUPorto – Sustainable Agrifood Production Research Centre/Inov4Agro, DGAOT, Faculty of Sciences, University of Porto, Campus de Vairão, Rua da Agrária 747, 4485-646 Vairão, Portugal

[3]Interdisciplinary Center of Social Sciences (CICS.NOVA), Nova University of Lisbon, Portugal.

ABSTRACT: This paper examines the institutionalization of agroecology in public policies across Portugal, Spain, and France, three Mediterranean countries that share similar ecological vulnerabilities and European Union policy frameworks yet display contrasting governance configurations. It argues that advancing agroecology as a transformative paradigm requires a systemic approach grounded in multi-level and multi-actor governance. The study combines a systematic review of 252 legislative and para-legislative instruments explicitly referring to agroecology with an expert questionnaire. Policy instruments are analyzed using Gliessman's five levels of food system transition, complemented by the Nyéléni Pillars, the FAO Elements, and the HLPE Principles. Results show that most policy references concentrate in Level 3 (agroecosystem redesign) and Level 4 (reconnection between producers and consumers), while Level 5 (system transformation) remains marginal. The findings indicate limited integration of participatory and redistributive governance. France shows strong institutionalization shaped by technocratic approaches, Spain a decentralized but weakly coordinated system driven by local initiatives, and Portugal fragmented, locally embedded actions focused on education and research. The paper concludes that governance remains a critical gap in the agroecological transition, and that strengthening coordination, participation, and inclusiveness is key to moving from technical adaptation towards systemic transformation.

KEYWORDS: Food systems; Systemic transition; Multi-level coordination; Policy implementation; Governance

I. Introduction

Public policies are central to enabling agroecological transitions. However, their incorporation into policy frameworks varies considerably, ranging from incremental improvements to systemic transformations. Social movements often frame agroecology as a transformative alternative to the dominant agri-food regime, whereas state institutions tend to narrow it down to technical practices or rural development measures, thereby depoliticizing its systemic potential and limiting its capacity to expose the tensions between state-led and grassroots approaches to sustainability (Giraldo & Rosset, 2017; Rivera-Ferre, 2018). Consequently, agroecology represents a key field within political ecology, which examines how power relations, governance structures, and economic systems shape environmental transformations and social inequalities. Research shows that public policies, when designed through participatory, territorial, and inter-institutional governance arrangements, can play a decisive role in scaling agroecology (Wezel *et al*., 2018; Gava *et al*., 2022, 2025), making it essential to examine their role in agroecological transitions.

The Mediterranean Basin is one of the world's main climate change hotspots, facing growing risks from rising temperatures, recurrent droughts, and chronic water scarcity. These factors interact with land-use change, urbanization, agricultural intensification, and biodiversity loss (Cramer *et al*., 2018; MedECC, 2020; Lazoglou *et al*., 2024). The resulting pressures – soil degradation, desertification, and declining agrobiodiversity – undermine the long-term resilience of regional food systems (Perez-Lucas *et al.,* 2024; MedECC, 2020). In Mediterranean agriculture, structural transformations have been profound: the number of farms is declining, land is becoming more concentrated, and rural populations are ageing (MedECC, 2020; ECA, 2024). However, in many regions, small family farms[3]remain predominant, sustaining livelihoods and territorial cohesion (MedECC, 2020). At the same time, demand for healthy and sustainable diets generates both market pressures and opportunities for low-input, local production, intensifying the tension between competitiveness and sustainability (Antonelli *et al*., 2022). Together, these economic, ecological, and social dynamics highlight the need for integrated

[3] Family farming is defined as agricultural production managed and operated by a family that resides on the farm and provides most of the labor. Beyond its productive dimension, family farming preserves and transmits local knowledge, protects natural resources, and sustains food security for rural households (FAO & IFAD, 2019). In this article, small farms refer to the ones with less than two hectares, generally excluded from EU support schemes under the Common Agricultural Policy (Viegas et al., 2023).

policies that enhance the adaptive capacity of small family farms and strengthen the sustainability of Mediterranean food systems (MedECC, 2020).

Agroecology offers a comprehensive response to the intertwined ecological, social, and economic challenges affecting Mediterranean food systems (Antonelli *et al*., 2022; Pérez-Lucas *et al*., 2024). By integrating ecological principles with social justice and territorial governance, it seeks to rebuild the resilience of farming systems, particularly small family farms, while promoting fair access to resources, decent livelihoods, and diversified local markets. Its emphasis on knowledge co-creation and participatory decision-making makes agroecology particularly relevant in Mediterranean contexts, where ecological fragility, diverse farming structures, and strong territorial identities call for governance models that connect environmental sustainability with social inclusion. This perspective draws on broader understandings of agroecology as a socially embedded, participatory, and politically transformative process (Giraldo & Rosset, 2017; Wezel *et al*., 2018; Rivera-Ferre, 2018).

Within this context, the evolution of European policy frameworks - most notably the Common Agricultural Policy (CAP) and the European Green Deal - has profoundly influenced the pathways and meanings of agroecology in Mediterranean Europe. Through their targets, instruments, and governance structures, they shape how Member States translate agroecological principles into practice. The European Green Deal (2019)[4] and its Farm to Fork Strategy (2020)[5] define the current agenda for sustainable food systems in the EU, setting ambitious goals: reducing pesticide and fertilizer use, protecting biodiversity, and bringing 25% of agricultural land under organic farming by 2030. They also emphasize the promotion of healthier diets and shorter supply chains, thereby advancing a systemic view of food systems aligned with agroecology. The Farm to Fork Strategy explicitly refers to agroecology as an approach to be promoted, particularly through research under the Horizon Europe Mission on Soil Health and Food and through eco-schemes within the CAP Strategic Plans.

Beyond these flagship strategies, additional European instruments contribute to this policy landscape but often operate in isolation. The Water Framework Directive (2000/60/EC)[6], the Sustainable Use of Pesticides Directive (2009/128/EC)[7] and the EU Biodiversity Strategy for 2030[8] complement the EU's sustainability agenda, yet their implementation remains fragmented. This fragmentation illustrates the persistent

[4] https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_en
[5] https://food.ec.europa.eu/food-safety-news/farm-fork-strategy-sustainable-food-while-protecting-environment-2019-12-20_en
[6] https://eur-lex.europa.eu/eli/dir/2000/60/oj
[7] https://eur-lex.europa.eu/eli/dir/2009/128/oj/eng
[8] https://environment.ec.europa.eu/strategy/biodiversity-strategy-2030_en

difficulty of aligning European instruments with territorial realities and multi-actor governance structures at national and local levels. Recent initiatives such as the EU Rural Pact and the activities of its Coordination Group (RPCG) seek to address this gap by promoting an integrated and participatory governance model for rural territories within the *Long-Term Vision for the EU Rural Areas*[9]. The subsequent 2025 Commission Communication, *A Vision for Agriculture and Food* [10], translates this call into a long-term policy roadmap for 2040, focused on competitiveness, fairness, and sustainability. Yet it mentions agroecology only once – as an example of an innovative and environmentally responsible farming practice attractive to younger farmers – rather than as a systemic approach to food system transformation. Overall, these initiatives do not appear to fully address the weaknesses already identified in existing instruments and may, in some cases, reinforce them.

The European Court of Auditors (ECA, 2024) found that while the 2023–2027 CAP Strategic Plans introduced a greener policy architecture (with stronger conditionality and mandatory eco-schemes), their implementation largely reproduces existing practices rather than supporting systemic transformation. Academic analyses confirm that the reform's design continues to favor incremental adjustments over structural change, reflecting the persistence of productivist logics and technocratic governance (Gascuel-Odoux *et al.,* 2022; Barral & Detang-Dessendre, 2023; Langlais, 2023). Over the past six decades, successive reforms – from the original CAP in 1962 to the MacSharry reform in 1992 and the integration of rural development measures – have progressively incorporated environmental and social objectives (Heyl *et al*., 2020; Viegas *et al*., 2023), yet the overall trajectory remains incremental: rather than redesigning food systems, policies seek to mitigate the externalities of intensive production. Scholars further note that by deliberately avoiding the term "agroecological transition" and preferring the broader expression "transition to sustainable agriculture", the reform may dilute its transformative scope (Linares-Quero *et al*., 2022; Langlais, 2023).

Consequently, while European frameworks set a general direction for sustainability, their operationalization across Member States remains uneven. The extent to which agroecology becomes embedded in public policy depends on how national administrations interpret and adapt EU guidelines within their governance systems (Gascuel-Odoux *et al*., 2022; Moeller *et al*., 2023). The CAP's reliance on financial incentives and performance indicators continues to privilege farm-level technical

[9] https://ruralpact.rural-vision.europa.eu/publications/rural-pact-coordination-group-rpcg-declaration-future-rural-areas-and-rural_en
[10] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52025DC0075

adjustments, often neglecting the social, territorial, and political dimensions that are central to agroecology (Barral & Detang-Dessendre, 2023). Portugal, for instance, shows limited institutionalization of agroecology, which remains primarily confined to scientific and educational domains (Gallardo-López *et al*., 2018). Its public policies continue to be largely shaped by the Common Agricultural Policy (CAP) and insufficiently adapted to the diversity of the country's family farming systems, which are central to sustaining rural livelihoods and agroecological potential (Costa-Pereira *et al*., 2025). Spain, by contrast, exhibits a more decentralized pattern: regional and municipal initiatives have promoted agroecological practices and local food networks, yet coordination at national level remains fragmented (Rivera-Ferre, 2018; López-García & Molina, 2021). In France, agroecology has gained strong policy visibility through national programmes such as the *Projet Agroécologique pour la France* (2012)[11] and the *Loi d'Avenir pour l'Agriculture, l'Alimentation et la Forêt* (2014)[12], but its implementation remains highly centralized and technocratic (González *et al*., 2018; Lamine *et al*., 2023).

The comparative analysis focuses on Portugal, Spain, and France—three Mediterranean countries that share similar ecological vulnerabilities and EU frameworks yet display contrasting governance systems. The selection of countries was based on three criteria: 1) a shared European Mediterranean context; 2) contrasting governance models—with agroecology primarily conceptualized as a scientific field in Portugal (Gallardo-López *et al.,* 2018), advanced mainly through decentralized regional and municipal initiatives in Spain (López-García & Molina, 2021), and framed through centralized and technocratic processes in France (González *et al*., 2018); and 3) the absence, so far, of studies comparing agroecological policy analysis across these three countries. In this context**,** centralized systems, such as France's, can mobilize resources and visibility but risk narrowing agroecology to efficiency goals; decentralized systems, as in Spain, foster experimentation and participatory innovation but suffer from coordination gaps; and weakly institutionalized contexts, such as Portugal, remain locally anchored with limited capacity for upscaling and policy coherence (Delgado, 2023). Analyzing how agroecology is integrated into public policy in Mediterranean Europe therefore contributes to broader debates on the institutionalization of environmental change, the depoliticization of sustainability transitions, and the possibilities for democratic governance of food systems.

Building on this comparative and governance-oriented perspective, the study examines how different governance configurations shape the institutionalization of agroecology in

[11] https://agriculture.gouv.fr/le-projet-agro-ecologique-en-france
[12] https://agriculture.gouv.fr/sites/default/files/160211_dp_laaf.pdf

public policy. It is based on the assumption that, although agroecology has gained growing political and institutional recognition, its transformative potential remains only partially embedded in public policy. To examine this, a systematic review of 252 legislative and para-legislative instruments explicitly referring to agroecology was conducted across the three countries. Each instrument was analyzed using Gliessman's (2016) five levels of food system transition and cross-referenced with the 11 Pillars of the Nyéléni Declaration (IFA, 2015)[13], the 10 Elements of Agroecology developed by the FAO (2018)[14], and the 13 Principles of Agroecology proposed by the HLPE (2019)[15]. This analytical framework provides a structured basis to assess whether policies promote incremental improvements or systemic transformations, while comparing how different governance configurations facilitate or constrain the institutionalization of agroecology. The analysis was complemented by an expert questionnaire conducted in the three countries. By combining these frameworks into a single operational classification applied to legislative and para-legislative instruments, the study also contributes methodologically to the assessment of agroecology in public policy.

II. Analytical framework and methodology

2.1. Analytical framework

This study draws on four complementary analytical frameworks widely recognized in the agroecology literature: 1) Gliessman's (2016) five levels of food system change, which distinguish incremental adjustments from systemic transformations; 2) the Nyéléni Declaration's 11 Pillars (IFA, 2015), which emphasize governance, rights, and equity; 3) the FAO's 10 Elements (2018), which provide operational guidance for governments; and 4) the HLPE's 13 Principles of Agroecology (2019), which link agroecology with food security and nutrition.

Together, these four frameworks provide complementary perspectives for assessing public policies. First, they enable an assessment of the degree of systemic transformation, that is, how far policies move from efficiency-oriented adjustments to structural change. Second, they support the evaluation of governance reach, understood as the extent to which policies foster participation, multi-level coordination, and social

[13] https://nyeleni.org/DOWNLOADS/Agroecology%20forum%202015/Final%20declaration%20Agroecology%202015%20EN.pdf
[14] https://www.fao.org/agroecology/overview/overview10elements/en/
[15] https://openknowledge.fao.org/server/api/core/bitstreams/ff385e60-0693-40fe-9a6b-79bbef05202c/content

equity. Taken together, they provide a comprehensive analytical lens to assess whether public policies promote incremental improvements or systemic transformations (Geck *et al*., 2023; Moeller *et al*., 2023; Soto *et al*., 2024).

The perspectives of Reboud and Hainzelin (2017), who call for multidimensional performance criteria in agroecological policies that integrate resilience, equity, and ecosystem services, reinforce the need for comprehensive evaluation frameworks. Likewise, Lamine *et al*. (2024) argue that resilience and transition should be understood as both socio-political and ecological processes, requiring multi-actor and multi-level governance. Together, these perspectives support and contextualize the analytical approach adopted in this study.

2.2 Operationalisation of the analytical framework

The analytical framework was operationalized by adapting and expanding the approach proposed by Soto et al. (2024), through the aggregation of Gliessman's five levels of food system change with the corresponding 11 Pillars of Nyéléni, FAO's 10 Elements, and HLPE's 13 Principles of Agroecology. This integration resulted in a multidimensional classification system linking incremental (Levels 1-2) and transformational (Levels 3-5) policy orientations. The resulting conceptual mapping is summarized in Table 1.

5 Levels (Gliessman)	11 Pillars (Nyéléni)	10 elements (FAO)	13 Principles (HLPE)
Level 1. Reduce use of costly/demanding inputs			
Level 2. Replace industrial inputs with ecological alternatives	6.**Strengthens autonomy of producers** (reducing dependence on external inputs)	3. **Efficiency** (reducing external inputs and improving resource-use efficiency (solar, nitrogen, water)	2. **Input reduction** (reduce/eliminate dependence on purchased inputs and increase self-sufficiency)
Level 3. Redesign agroecosystem based on ecological alternatives	4.**Works with nature** (ecological principles, soil life, biodiversity, energy conservation)	1. **Diversity** (rotations, polycultures, trees integration, crop–livestock, aquaculture)	1.**Recycling** (preferentially use local renewable resources and close nutrient/biomass cycles)
		2. **Synergies** (e.g. integrated rice–fish, hedgerows, crop–livestock)	3. **Soil health** (secure and enhance soil health and functioning)
		4. **Resilience** (ecological: diverse systems resisting pests and shocks)	4. **Animal health** (ensure animal health and welfare)
		5.**Recycling** (closing nutrient/biomass/water cycles via compost, manure, crop–livestock integration)	5. **Biodiversity** (maintain and enhance species and genetic diversity across scales)
			6. **Synergies** (enhance positive ecological interactions, integration, and complementarity)

			7.**Economic diversification** (diversify on-farm incomes and add value locally)
Level 4. Reconnection - connect producers and consumers, build new markets	2.**Focuses on food for people**	4. **Resilience** (socio-economic: diverse incomes, markets).	9. **Social values and diets** (base food systems on equity, identity, culture, and healthy diets)
	10.Builds local food systems (short chains, solidarity markets, territorial food webs)	6 .**Co-creation of Knowledge** (horizontal learning, campesino-a-campesino, participatory governance)	8. **Co-creation of knowledge** (enhance horizontal sharing of local and scientific knowledge)
	3.**Builds knowledge and skills** (horizontal, intergenerational, diálogo de saberes)	8.**Culture and food traditions** (anchors diets and food systems in local traditions and identities)	10.**Fairness** (support dignified livelihoods and fair trade/employment/intellectual property rights)
	5. **Builds on the knowledge of peasants and indigenous peoples**	10. **Circular economy** (short food supply chains, participatory guarantee schemes, local markets)	11. **Connectivity** (strengthen links between producers and consumers via local economies)
	11.Promotes diverse knowledge systems (plural epistemologies, multiple worldviews, co-creation)		
	6.Strengthens autonomy of producers (reducing dependence markets)		
Level 5. System transformation – equity, governance, global food system change	**1.Build food sovereignty**	7. **Human and social values** (rights, equity, inclusion, empowerment (women, youth, marginalized groups)	12. **Land and resource governance** (ensure equitable access, recognition of smallholders.)
	7.Puts control of seeds, biodiversity, and commons in the hands of people	9. **Responsible governance** (calls for inclusive, accountable, multi-scale governance (land rights, policy frameworks)	13. **Participation** (promote collective action and decision-making in food system governance)
	8.Builds economic and social justice, and fights oppression		
	9.Defends natural resources (land, water, territories, commons)		

Table 1 - Mapping of Gliessman's five levels of food system change with the Nyéléni Pillars (IFA, 2015), FAO Elements, and HLPE Principles of Agroecology. Light grey: incremental (Levels 1–2); Dark grey: transformational (Levels 3–5). (Adapted from Soto *et al*., 2024)

2.3 Data sources and selection

The empirical analysis was conducted at two levels: 1) a systematic review of legislative and para-legislative instruments[16] explicitly referring to agroecology; and 2) an expert consultation carried out to reinforce the findings of the instruments analysis and ensure consistency and relevance.

[16] Legislative instruments defined as binding legal acts establishing general and abstract rules - include, for Portugal: Lei, Decreto-Lei, and Resolução da Assembleia da República; for Spain: Ley, Ley Orgánica, Real Decreto-ley, Decreto-ley, and Real Decreto (when normatively general); and for France: Loi, Décret (with general regulatory content), and Résolution parlementaire (with normative value). Para-legislative instruments defined as non-binding or infra-legal acts supporting the implementation of legislation without creating new legal obligations - include, for Portugal: Despacho and Portaria; for Spain: Orden Ministerial and Resolución; and for France: Arrêté — as well as circulars, guidelines, action plans, and international cooperation agreements.

The systematic review was conducted using the official legislative journals of each country, applying the search term a*groecol** and its linguistic variations. The analysis covers the period from the first legislative cycle in Portugal (1976) and Spain (1979), and from the first legislature of the Fifth Republic in France (1958), all up to 31 July 2025, namely: Portugal - *Diário da República*[17]; Spain - *Boletín Oficial del Estado (BOE)*[18]*;* and France - *Journal Officiel de la République Française*, accessed via *Légifrance*[19].

Inclusion criteria: Instruments were included when they contained the term *agroecol** in the title, preamble, or operative sections and were publicly available in the official databases of each country. **Exclusion criteria:** Instruments were excluded when their content was purely administrative or procedural – that is, acts concerning internal management or administrative formalities that do not establish or regulate public policies, such as appointments, competitions, public notices, individual authorizations, or judicial decisions. Documents were also excluded when the term "agroecology" referred exclusively to agroecological zones/areas/regions defined by natural soil and climate conditions (e.g., geology, pedogenesis, slope, exposure, altitude). In such cases, "agroecology" is used as a biophysical classification related to land or habitat conservation, rather than as a policy concept concerning agricultural practices, food systems, or governance.

2.4 Analytical procedure

The analytical procedure followed a stepwise approach designed to ensure transparency, cross-country comparability, and replicability. It was implemented in four sequential stages: 1) Identification of relevant legislative and para-legislative instruments; 2) Classification of the legislative and para-legislative instruments according to Gliessman's levels; 3) Expert consultation and 4) Comparative synthesis of results.

Stage 1 | Identification of relevant legislative and para-legislative instruments: All instruments meeting the inclusion criteria were catalogued in a database. Each entry included metadata on the date of the instrument, title, summary, excerpt containing *agroecol**, scope (national, regional/territorial, European, international, or education/training/research), issuing authority, and the institutions involved in both the creation and implementation of the instrument. When the same instrument contained

[17] https://diariodarepublica.pt/dr/home
[18] https://www.boe.es/
[19] https://www.legifrance.gouv.fr/

multiple occurrences of the terms “agroecology,” “agroecological,” or variations, it was recorded only once to avoid duplication in the quantitative analysis. Amendments and updates were retained as separate records, as variations in the formulation or contextual use of the term “agroecology” over time are relevant to understanding its evolving policy meaning and framing. The instruments were then classified according to their legal status (legislative or para-legislative) and the country of origin (Portugal, Spain, or France).

Stage 2 | Classification of the legislative and para-legislative instruments according to Gliessman’s levels: Each policy instrument was classified according to Gliessman’s five levels of food system change, using the multidimensional correspondence between levels and the Nyéléni, FAO, and HLPE frameworks summarized in Table 1. To guide this process, a list of operational keywords was developed by the authors, drawing on two complementary sources: 1) the conceptual correspondence between frameworks summarized in Table 1, and 2) the original texts of Gliessman’s levels, the Nyéléni Declaration, the FAO’s 10 Elements and the HLPE’s 13 Principles. The resulting list of operational keywords used for the classification of policy instruments is presented in Table 2.

GLIESSMAN Level	Sub-level	keywords
2. **Replace** industrial inputs with ecological alternatives	Efficiency / Input reduction	efficient use of resources reduce external inputs reduce agrochemicals and synthetic fertilizers low external input/ low emissions optimize energy and water use
3. Redesign agroecosystem based on ecological alternatives	Works with nature / Diversity	crop rotation polycultures / intercropping / mixed cropping tree–crop integration crop–livestock integration aquaculture integration genetic diversity / seed diversity diversified systems / mixed farms
	Works with nature / Recycling	compost / manure / organic fertilization nutrient recycling / closing cycles water reuse / wastewater treatment biomass use / residues valorisation integration of livestock and crops for recycling
	Works with nature / Synergies, Resilience, Biodiversity	biodiversity / biological corridors / connectivity ecological interactions / ecological synergies/ ecological corridors resilience to shocks / adaptation to climate change integrated pest management / natural enemies ecosystem services / pollinators complementarities between species, crops or systems
	Works with nature / Soil health	soil fertility / soil conservation erosion control / anti-erosion regeneration / restoration of soils cover crops / mulching reduced tillage soil organic matter
	Animal health	animal welfare / well-being

		animal health / veterinary prevention integrated livestock systems pastoralism
4. Reconnection -connect producers and consumers, build new markets	Builds local food systems / Connectivity	local markets / short food chains / direct sales territorial food webs / solidarity markets local value chains producer-consumer links
	Builds knowledge and skills / Co-creation of knowledge	education / training / capacity building research / innovation / knowledge transfer peasant-to-peasant / farmer-to-farmer learning intergenerational knowledge / dialogue of knowledges participatory research / co-creation with farmers combination of scientific and local knowledge
	Focuses on food for people / Culture and food traditions	typical products / traditional products / regional identity food culture / culinary heritage healthy diets / nutrition equity in diets / access to healthy food cultural anchoring of food
	Strengthens autonomy of producers / Fairness / Resilience/ Circular economy	autonomy of farmers / self-reliance dignified livelihoods / fair income fairness in trade / decent employment reduce market dependency/ circular economy social protection for farmers / equity in incentives economic resilience of rural households
5. System transformation – equity, governance, global food system change	Build food sovereignty / Human and social values	food sovereignty human rights / right to food equity / inclusion / justice / solidarity empowerment (women, youth, marginalized groups) fight against poverty / oppression / exclusion collective rights of rural communities
	Defends natural resources / Responsible governance	governance of resources (land, water, seeds, biodiversity) participation / participatory governance commons / common goods / collective management access to land / land rights / land reform seed sovereignty / seed banks / farmers' rights multi-level governance

Table 2 - Operational keywords derived from the conceptual mapping in Table 1 and used to classify policy instruments according to Gliessman's five levels of agroecological transition. Light grey: incremental (L2); Dark grey: transformational (L3–L5).

The analysis focused on the paragraph or sentence where the term "agroecology" appeared, ensuring that the classification captured the specific policy meaning and contextual use of the concept in each instrument. Each instrument was then classified at one or more levels or sub-levels, according to the number and type of keywords identified. As a result, a single instrument could generate multiple occurrences across levels and sub-levels in the analysis. Level 1 (efficiency improvements within conventional systems) was not applied, as these measures represent incremental optimizations of the dominant agri-food model rather than a transition towards agroecology. This exclusion is consistent with the analytical scope of the study, which focuses on instruments explicitly engaging with agroecological principles and systemic transformation.

Stage 3 | Expert consultation: An online questionnaire was carried out between 25 September and 5 October 2025, through professional networks and organizations, including Agroecology Europe and the Agroecology Coalition, as well as additional

specialists identified through snowball sampling. The survey was addressed to experts from Portugal, Spain, and France with professional experience in agroecology-related policies or practices. Experts were asked to: a) identify the three legal or policy instruments that, in their view, were most relevant to the development of agroecology in their country over the past twenty years; b) provide a brief justification for each policy instrument; and c) select the Gliessman's levels and sub-levels of transition (L2–L5) each instrument sought to operationalize. The questionnaire complemented the classification of legislative and para-legislative instruments by providing qualitative insights into how practitioners and researchers perceive the relevance and governance depth of these measures. Responses were summarized by country, instrument, and dominant transition level, enabling comparison with the results of the instruments analysis.

Stage 4 | Comparative synthesis of results: In the final stage, the findings from the systematic review of the policy instruments were compared with the insights gathered from the expert consultation. This comparative synthesis aimed to identify areas of convergence and divergence between policy design and expert perceptions of implementation and transformative potential. The integration of both analyses provides a broader and more nuanced understanding of how agroecology is institutionalized in public policy across Portugal, Spain, and France.

Study limitations: This study relies exclusively on the keyword *agroecol* (and its linguistic variants), which ensures comparability but may exclude related policies framed under other terms (e.g., organic or sustainable farming). The analysis is limited to excerpts from official publications, which may underrepresent certain agroecological dimensions or informal practices. The research evaluates the institutionalization of agroecology in law and policy, not their implementation or on-the-ground impacts. Expert sampling was purposive and may reflect network bias, while reported outcomes depend on expert perception rather than independent verification. Translation of sources may have reduced nuance or contextual specificity. Legal and administrative architectures differ across the three countries, which may affect the cross-national comparability of findings.

III. Results

This section presents the comparative results, detailing the main legislative and para-legislative instruments identified in each country and their distribution across

Gliessman's levels of transition (L2–L5), as well as the main insights emerging from the expert consultation.

3. 1. Legislative and para-legislative instruments

The analysis identified a diverse set of legislative and para-legislative instruments explicitly referring to agroecology across Portugal, Spain, and France. To contextualize the comparative analysis, Table 3 summarizes all policy instruments identified in Portugal, Spain, and France containing the term "agroecology", distinguishing those excluded from those included in the analysis.

			Portugal	Spain	France
		Total of instruments found	**130**	**185**	**255**
Excluded instruments		Corporate agreements/acts	12		
		Competitions, juries and appointments	41		72
		Internal information (including holiday approval)			118
		Agroecological zones/areas/regions	55	20	
		Total instruments excluded	**108**	**20**	**190**
Instruments included	**Legislative Instruments**	Law (ordinary/organic/regional)	2	81	6
		Decree-Law/Royal Decree-Law		30	8
		Resolution of the Assembly of the Republic/ of the Council of Ministers	2		4
	Para-legislative instruments	Order/Notice/Announcement	17		
		Resolution		26	
		Ministerial Order/Agreement of the Governing Council		18	
		Regulation (sub-legal), Regulation (EU) and Decision (EU)/Joint Committee Act	1	10	
		Convention/Decision/List			7
		Order			40
		Total instruments included	**22**	**165**	**65**

Table 3 - Included and excluded policy instruments referring to "agroecology" in Portugal, Spain, and France

The following analysis presents how references to "agroecology" are distributed across legislative and para-legislative instruments in Portugal, Spain, and France.

Portugal: Between 1979 and 2025, a total of 130 legislative and para-legislative instruments were identified, of which 22 were included in the analysis. Most references fall under *Sub-Level 4: Builds knowledge and skills (13* instruments), reflecting the dominant role of higher education and research institutions. Smaller groups appear in *Level 2: Efficiency/Input reduction* (6 instruments) and *Sub-Level 3: Synergies/Resilience/Biodiversity* (6). Less frequent references occur *in Sub-Level 4:*

Strengthens autonomy of producers (3)**,** *Sub-Level 5: Defends natural resources* (3), *Sub-Level 3: Diversity* (2), *Sub-Level 3: Soil health* (1), and *Sub-Level 5: Food sovereignty* (1). No references were found for *Recycling* or *Animal health*.

Multi-level articulation is limited: 17 instruments are associated to a single level - e.g. the master's degree in Agroecology (Despacho No. 3669/2008) from the Polytechnic Institute of Bragança and the Resolution of the Assembly of the Republic No. 142/2017, promoting research and innovation in agroecology (both *Sub-Level 4: Builds knowledge and skills*). Six instruments with two levels, such as Despacho No. 7659/2024, which revised the Master's in Sustainable Agriculture to include the course Agroecology and Biodiversity (*Sub-Levels: Synergies/Resilience/Biodiversity and Builds knowledge and skills*). Three instruments are associated with three levels: notably, the Lei de Bases do Clima (Law on Climate Foundations), which created the Council for Climate Action and mandates the promotion of agroecology under low-carbon agriculture (*Level: Input reduction, and Sub-levels: Synergies/Resilience/Biodiversity and Defends natural resources*). Only one instrument (Edital No. 865/2025 from Valença Municipality), approving the Municipal Regulation on Incentives for Agricultural Production in Integrated and Organic Farming Modes, combines five sub-levels (*Efficiency, Diversity, Soil health, Builds local food systems, and Builds knowledge and skills*). The regulation explicitly promotes the application of agroecological and multifunctional agriculture concepts as drivers of sociological, ecological, and local resource valorization transformation.

By scope, instruments concentrate in Education/Research (13), followed by Territorial/Regional (7) and National (2). Most are para-legislative instruments (ministerial dispatches, course approvals, municipal regulations) focused on education, training, and local governance. Policy creation is mainly led by the Ministry of Education and higher education institutions, while implementation is carried out by training institutes and municipalities, revealing a fragmented and locally anchored institutionalization of agroecology in Portugal.

Spain: Between 2001 and 2025, a total of 185 policy instruments containing the term "agroecology" were identified, of which 165 were analyzed. This distribution is strongly dominated by *Sub-Level 4: Builds knowledge and skills* (139 instruments), confirming the central role of vocational training and higher education. Additional concentrations appear in *Sub-Level 3: Synergies/Resilience/Biodiversity* (36) and *Sub-Level 4: Builds local food systems* (23). Other relevant categories include *Sub-Level 4: Strengthens*

autonomy/Fairness (15), *Sub-Level 5: Builds food sovereignty* (14), and *Sub-Level 5: Defends natural resources* (10). Mentions under *Sub-Level 3: Soil health* (10) are also frequent, while *Diversity* (7), *Recycling* (6), *Animal health* (5), and *Focuses on food for people* (2) are less common.

Multi-level articulation is more present than in Portugal: 101 instruments are associated with a single level - for instance, the General State Budget Laws of several autonomous communities establishing training programmes in Agroecological Production (*Sub-Level 4: Builds knowledge and skills*) or Law 10/2023 of the Balearic Islands, which integrates agroecology and food sovereignty into its sustainability framework (*Sub-Level 5: Builds food sovereignty*). Fifteen instruments with two levels, such as Law 13/2023 of Aragón, promoting circular bioeconomy contracts and short agroecological food chains (*Sub-Levels: Builds local food systems and Strengthens autonomy of producers*). Six instruments with three levels - e.g. Royal Decree 1047/2022, regulating CAP management systems and including carbon farming and agroecology eco-schemes (*Sub-Levels: Diversity, Recycling, and Synergies/Resilience/Biodiversity*). Eight instruments with four levels, including the Resolution of 10 November 2011 (University Pablo de Olavide) establishing the *Master's in Agroecology, An Approach to Rural Sustainability*, which integrates ecological, social, and political dimensions of agroecology (*Sub-Levels: Synergies/Resilience/Biodiversity; Builds knowledge and skills; Strengthens autonomy; Builds food sovereignty*). One instrument, Law 5/2019 of the Valencian Community, is associated with five sub-levels (*Efficiency/Input reduction; Synergies/Resilience/Biodiversity; Soil health; Strengthens autonomy; Defends natural resources*)**,** promoting sustainable and agroecological farming, resource circularity, and rural development. Finally, two instruments - Law 2/2024 on Demographic Impulse, which promotes the dynamization of local agroecological systems, associated with *Level 3 (Ecosystem redesign*), *4 (Producer–consumer reconnection), and 5 (System transformation)*, and Order CIN/533/2022 (State Research Plan), which advances territorial agricultural sustainability based on agroecological principles and living laboratories associated with *Levels 2 (Efficiency), 3 (Redesign), 4 (Reconnection), and 5 (Transformation).*

By scope, Spain's instruments are concentrated in Education/Training/Research (131)**,** followed by European/International (15), Territorial/Regional (11)**,** and National (8). Most are royal decrees, ministerial orders, and regional regulations, complemented by educational and research frameworks. Policy creation is largely centralized (Parliament, ministries, European Commission), while implementation is decentralized (autonomous communities, the Spanish Agricultural Guarantee Fund – FEGA, universities, and local

actors), confirming a multi-level governance model with a strong educational and scientific orientation.

France: From 2011 onwards, agroecology became progressively integrated into environmental certification and biodiversity regulations, marking a broader institutional shift. A total of 255 instruments were identified, of which 65 were analyzed. The distribution is led by *Sub-Level 4: Builds knowledge and skills* (30 instruments) and *Sub-Level 3: Synergies/Resilience/Biodiversity* (24), followed by *Level 2: Efficiency/Input reduction* (14). Other concentrations appear under *Sub-Level 4: Strengthens autonomy of producers (*10), *Sub-Level 3: Animal health* (9)**,** and *Sub-Level 5: Defends natural resources* (7). Less frequent references occur in *Sub-Level 4: Builds local food systems* (5), *Sub-Level 3: Diversity* (3), *Sub-Level 5: Builds food sovereignty* (2), and *Sub-Level 3: Soil health* (1), while *Recycling* and *Focuses on food for people* show no occurrences.

Multi-level articulation is moderate: 42 instruments are associated with a single level - for instance, the Arrêté of 20 June 2011, defining the environmental certification framework for farms and requiring the identification of agroecological infrastructures (*Sub-Level 3: Synergies/Resilience/Biodiversity*), or the Arrêté of 23 January 2024, establishing the specialized landscape worker certification, which links agroecological challenges to professional practice (*Sub-Level 4: Builds knowledge and skills*). Thirteen with two levels, such as the Agricultural Vocabulary List (2023), which defines agroecology as a strategy extending ecological practices to all cultivable spaces (*Sub-Levels: Synergies/Resilience/Biodiversity and Builds knowledge and skills*). Five instruments with three levels - e.g., the Arrêté of 23 January 2024 establishing the livestock and forage worker certification, which connects ecological practices, resource management, and agroecological awareness *(Sub-Levels: Synergies/Resilience/Biodiversity; Builds knowledge and skills; Defends natural resources*). Seven instruments with four levels, including the *Loi d'Avenir pour l'Agriculture, l'Alimentation et la Forêt* (2014), which institutionalized agroecology through biodiversity management, short food chains, and producer autonomy (*Sub-Levels: Synergies/Resilience/Biodiversity; Builds local food systems; Builds knowledge and skills; Defends natural resources*). Finally, one instrument - the Arrêté of 23 January 2024 creating the Fruit Arboriculture Production Certificate – is associated with five sub-levels (*Efficiency/Input reduction, Diversity, Synergies/Resilience/Biodiversity, Builds local food systems, and Builds knowledge and skills*), promoting collective agroecological projects under the *Groupements d'Intérêt Économique et Environnemental (GIEE*) framework.

By scope, most instruments are national (36), followed by Education/Training/Research (22), Territorial/Regional (6), and European (1). Policy formulation is led by Parliament and the Ministries of Agriculture and Ecological Transition, while implementation involves technical agencies (INRAE, FranceAgriMer) and regional agricultural education authorities (DRAAF). Overall, France presents the most extensive and cross-sectoral set of policy instruments referring to agroecology.

Across Portugal, Spain, and France, a total of 570 policy instruments explicitly referring to agroecology were identified, of which 252 met the inclusion criteria. Most are para-legislative - including ministerial orders, resolutions, circulars, and local regulations - while legislative acts represent a smaller share. As shown in Table 4, references concentrate overwhelmingly in *Sub-Level 4: Builds knowledge and skills*, which accounts for 44% of all occurrences, followed by *Sub-Level 3: Synergies/Resilience/Biodiversity* (16%) and *Level 2: Efficiency/Input reduction* (7%). Level 5 references (*Sub-levels Build food sovereignty and Defend natural resources*) together represent 9% of all cases. These results show that most policy instruments referring to agroecology are associated with education, training, and knowledge exchange domains, while fewer address ecological redesign or governance-related dimensions.

	PORTUGAL	SPAIN	FRANCE	TOTAL	% of TOTAL
L2. Efficiency/input reduction	6	9	14	**29**	**7%**
L3. Diversity	2	7	2	**12**	**3%**
L3. Works with nature/Recycling	0	6	0	**6**	**1%**
L3. Works with nature/Synergies/Resilience/Biodiversity	6	36	24	**66**	**16%**
L3. Works with nature/Soil health	1	10	1	**12**	**3%**
L3. Animal health	0	5	9	**14**	**3%**
L4. Builds local food systems/Connectivity	1	23	5	**29**	**7%**
L4. Builds knowledge and skills/Co-creation of knowledge	13	139	30	**182**	**44%**
L4. Focuses on food for people/ Culture and food traditions/	0	2	0	**2**	**0%**
L4. Strengthens autonomy of producers/Fairness/Resilience	3	15	10	**28**	**7%**
L5. Build food sovereignty/ Builds economic and social justice, and fights oppression	1	14	3	**18**	**4%**
L5. Defends natural resources/Responsible/Land and resource governance	3	10	7	**20**	**5%**
			TOTAL	**417**	**100%**

Table 4 | Distribution of legislative and para-legislative policy instruments referring to "agroecology" in Portugal, Spain, and France by Gliessman's levels and sub-levels (1979–2025), including percentage of total per level. Light grey: incremental (L2); dark grey: transformational (L3–L5).

3. 2. Expert consultation

Table 5 summarises the instruments identified by experts and their distribution across Gliessman's levels. The questionnaire results complement the instruments review by providing qualitative insights into how different actors perceive the institutionalization of agroecology in each country.

	PORTUGAL	SPAIN	FRANCE	TOTAL	% of TOTAL
L2. Efficiency/input reduction	7	9	3	**19**	**10%**
L3. Diversity	10	7	1	**18**	**9%**
L3. Works with nature/Recycling	4	7	1	**12**	**6%**
L3. Works with nature/Synergies/Resilience/Biodiversity	9	6	1	**16**	**8%**
L3. Works with nature/Soil health	9	5	3	**17**	**9%**
L3. Animal health	7	5	1	**13**	**7%**
L4. Builds local food systems/Connectivity	10	10	5	**25**	**13%**
L4. Builds knowledge and skills/Co-creation of knowledge	7	3	2	**12**	**6%**
L4. Focuses on food for people/ Culture and food traditions/	6	7	3	**16**	**8%**
L4. Strengthens autonomy of producers/Fairness/Resilience	8	8	1	**17**	**9%**
L5. Build food sovereignty/ Builds economic and social justice, and fights oppression	5	6	4	**15**	**8%**
L5. Defends natural resources/Responsible/Land and resource governance	6	3	4	**13**	**7%**
			TOTAL	**193**	**100%**

Table 5 | Distribution of policy instruments mentioned by experts in Portugal, Spain, and France by Gliessman's levels (L2–L5), including percentage of total per level. Light grey: incremental (L2); dark grey: transformational (L3–L5).

Portugal: Seven experts answered the questionnaire, representing civil society organizations, a professional association, academia, and the farmers' confederation. They identified nine relevant instruments, mostly operating at *Levels 2–4*. The Family Farming Statute (2018) was viewed as the most symbolic step towards recognizing small and family farms but still limited to compensatory measures rather than systemic reform

(*Level 4–Level 5*). The National Strategy for Organic Farming (ENAB, 2017) and the CAP agri-environmental measures were mentioned by experts as relevant for promoting biodiversity and soil management (*L3–L4*), even though these instruments do not include explicit references to agroecology. They were considered important for aligning production practices with agroecological principles, yet insufficient to transform the dominant production model. Similarly, the Circular Economy Action Plan (PAEC) and the National Programme for the Promotion of Healthy Eating (PNPAS) were highlighted for linking agroecology to food waste reduction and nutrition (*L2–L4*), but again without directly referring to the concept, and without addressing governance integration. Experts highlighted the absence of a national legal framework explicitly defining agroecology. Existing policies are perceived as largely incremental, centered on efficiency, organic production, and local initiatives, without advancing multi-level governance or systemic transformation.

Spain: Nine Spain-based experts, representing universities, public research institutes, cooperatives, and applied research organizations, answered the questionnaire and identified eleven policy instruments reflecting a broad but fragmented system centered on efficiency, organic certification, and local food networks (*Levels 2–4*). The National CAP Strategic Plan (PEPAC) was viewed as central in shaping agricultural practices but largely confined to efficiency and environmental objectives (*L2–L3*). Regulation (EU) 2018/848 on organic production and labelling was also highlighted for harmonizing standards, though limited to certification without broader territorial or governance scope (*L2–L4*). More transformative approaches were highlighted in urban food strategies and public procurement initiatives (*L4–L5*), which reconnect production and consumption through local governance. One expert noted that no single instrument has effectively promoted agroecology nationally, pointing instead to isolated regional or municipal measures, particularly in public procurement. Overall, expert feedback suggests a multi-level but fragmented policy landscape in which agroecology advances mainly through regional and local initiatives, public procurement, and organic regulation, with instruments concentrated at *Levels 2–4* and limited progress towards *Level 5*.

France: Five France-based experts responded to the questionnaire, representing public research institutions, NGOs, and international networks. They consistently identified the *Loi d'Avenir pour l'Agriculture, l'Alimentation et la Forêt* (2014) as the institutional turning point for agroecology, making it a national objective of agricultural policy, and the *Loi EGALIM* (2018) as a key measure translating agroecological principles into public

procurement and food governance *(Levels 2–5).* Complementary instruments - such as pesticide regulation, the *EU Sustainable Use Directive* (SUD), the *Dephy Farms Network promoting Integrated Pest Management* (IPM) and farmer–researcher collaboration, as well as local policies on organic school canteens (*Levels 4–5*) - were cited for fostering collective learning and environmental efficiency. Experts noted, however, that implementation is often perceived as largely technocratic, with limited participatory governance.

Across the three countries, experts most frequently associate agroecology with *Levels 2–4*, corresponding to efficiency, organic production, and local food systems. As shown in Table 5, the majority of references concern *Builds local food systems* (13%), followed by *Efficiency/Input reduction* (10%), *Diversity* (9%), *Soil health* (9%), *Strengthens autonomy/Fairness* (9%), and *Build food sovereignty* (8%), while notably *Builds knowledge and skills* (6%) remain less represented - in contrast to the documentary analysis, where this sub-level dominates. These results suggest that experts across the three countries tend to emphasize practical and locally grounded approaches to agroecology, focusing on short supply chains, ecological management, and the strengthening of producers' autonomy, while fewer references relate to *Level 5*.

3. 3. Cross-comparison of policy instruments and expert assessments

Across the three countries, both policy references and expert perceptions indicate a predominant concentration in *Level 3: ecosystem redesign* and *Level 4: reconnection between producers and consumers*. For policy instruments, *Level 4* is dominant in all three countries, followed by *Level 3*, suggesting that agroecology is mainly addressed through education, knowledge transfer, and local food systems rather than through governance reform. Among experts, the pattern differs slightly: in Portugal and France, *Level 4* remains the main reference, while in Spain, *Level 3* is most frequently emphasized, pointing to a relatively stronger focus on ecological management and production practices. Overall, both sources highlight the predominance of knowledge-oriented and territorially grounded approaches, with limited integration of *Level 5: System transformation*, although French experts refer to this level more frequently (Table 6).

INSTRUMENTS	EXPERTS	INSTRUMENTS	EXPERTS	INSTRUMENTS	EXPERTS

L2.	17%	8%	3%	12%	13%	10%
L3.	25%	33%	23%	39%	35%	24%
L4.	47%	35%	65%	37%	42%	38%
L5.	11%	13%	9%	12%	9%	28%
	PORTUGAL		SPAIN		FRANCE	

Table 6 |- Percentage distribution of legislative and para-legislative instruments and expert perceptions across Gliessman's levels 2-5 in Portugal, Spain, and France. Light grey: incremental (L2); dark grey: transformational (L3–L5).

IV. DISCUSSION

This study examined how public policies in Portugal, Spain, and France integrate agroecology, comparing their institutional configurations, actor constellations, and degrees of systemic transition. The results support the initial hypothesis: although agroecology is increasingly recognized in policy discourse, its integration into public policy remains partial and uneven across the three countries. Rather than assessing policy outcomes or effectiveness, the analysis focused on the type of instruments, their scope, and how they reflect different understandings of agroecology – encompassing technical improvement, ecological redesign, knowledge co-creation, local food systems, and, to a lesser extent, system transformation.

The following sections compare the national trajectories of Portugal, Spain, and France, highlighting their main institutional characteristics and policy orientations. The discussion concludes with a cross-country synthesis of how agroecology is positioned within public policy, from incremental adjustments (*Levels 2-4)* to more limited and emerging elements of system transformation (*Level 5*).

Portugal: Agroecology in Portugal remains weakly institutionalized and largely absent from national policy frameworks. Both policy instruments and expert evidence point to a fragmented, locally anchored policy environment dominated by education, research, and municipal initiatives – originating mainly from higher education institutions and local authorities. This limited scope corroborates Gallardo-López et al. (2018), who place Portugal among the European countries where agroecology remains primarily a scientific field rather than a political or policy movement. The evidence from policy instruments suggests weak articulation between local initiatives and national strategies, reflecting limited institutional coordination and the absence of mechanisms linking different governance levels. The Family Farming Statute (2018) and the National Strategy for Organic Farming (ENAB, 2017) were mentioned by experts but do not include the term

"agroecology". Both focus on sustainable or organic production without framing these measures under an agroecological approach. The Common Agricultural Policy (CAP) continues to favor large-scale, commodity-oriented systems while providing limited support to low-input, diversified farms (Costa-Pereira et al., 2025), leaving almost 40% of Portuguese farmers without CAP support, and nearly 60% among farms under two hectares. This reflects persistent inequalities (Viegas et al., 2023), which have prompted civil society to call for more inclusive governance in the preparation of the CAP Strategic Plan (PEPAC) (Viegas et al., 2024). The ENAB (2017) strategy likewise adopts a technocratic approach, promoting organic production through certification and market incentives but lacking mechanisms for participation or coordination across governance levels. Overall, Portugal's policy landscape points to a symbolic recognition of agroecology with limited institutionalization, as education, research, and local initiatives dominate in the absence of a legal definition and coherent multi-level framework.

Spain: Agroecology in Spain follows a broader but fragmented trajectory, reflecting the country's multi-level governance system, where autonomous communities share responsibilities for policy design and implementation alongside national and EU frameworks. References to agroecology appear across environmental, agricultural, and territorial domains, mainly through measures on agroecosystem redesign (*Level 3*) and reconnection (*Level 4*). References emphasize biodiversity conservation, circular economy, short supply chains, and rural development, showing that agroecology is framed primarily as a tool for ecological management and territorial innovation rather than as a governance framework. The absence of a coherent national framework limits policy articulation across scales. Most policy instruments are linked to research, education, regional planning, and local development programmes, particularly those under the CAP and regional organic farming strategies. Experts mentioned the CAP Strategic Plan (PEPAC), EU Regulation 2018/848 on organic production, and regional organic farming plans as key reference points, noting that they associate agroecology with environmental and technical objectives but without establishing mechanisms for participatory governance or national coordination. At the local level, municipal food policies, LEADER programmes, and the *Red de Ciudades por la Agroecología* illustrate more participatory dynamics, where agroecology is connected to urban–rural linkages and local food networks (López-García & González de Molina, 2021). These findings align with previous analyses (Rivera-Ferre, 2018; Márquez-Barrenechea et al., 2020; Espluga-Trenc et al., 2021) which describe Spain's agroecological transition as multi-scalar but weakly integrated, with municipalities and local networks acting as experimental spaces rather than components of a coherent national strategy. As López-

García et al. (2023) observe, this configuration reflects a “politics of recognition”, where agroecology gains visibility in public discourse but remains marginal in formal decision-making structures. Overall, Spain presents a participatory yet fragmented configuration: progress is visible in ecological management and local food systems (*Levels 3-4*), while references to *Level 5* remain limited in the absence of a national agroecology framework.

France: Agroecology in France represents the most consolidated and institutionally embedded case among the three countries. Both the analysis of policy references and expert perceptions indicate that it has been integrated across multiple policy domains: agriculture, environment, food, and research. References to agroecology are relatively balanced across *Level 3* and *Level 4*, while *Level 5* appears less frequently in formal policy texts. Experts, however, placed greater emphasis on this level, reflecting stronger recognition of governance and social justice dimensions than in Portugal or Spain. The *Loi d’Avenir pour l’Agriculture, l’Alimentation et la Forêt* (2014) marked the key legislative milestone by establishing agroecology as a national policy objective, preceded by the *Projet Agroécologique pour la France* (2012) and followed by the *Loi EGALIM* (2018). These measures introduced diversification incentives, collective action through the *Groupements d’Intérêt Économique et Environnemental* (GIEE), and public procurement targets for local and organic products, aligning production, consumption, and sustainability objectives. Experts consistently identified these instruments as central to the French agroecological framework, noting that they link agri-environmental measures with market and social objectives but remain framed within state-led, technocratic structures. This finding aligns with previous analyses that describe the French model as comprehensive yet hierarchical (González et al., 2018; Lucas, 2021; Lamine et al., 2023). Lamine et al. (2023) observe that agroecology has been mainstreamed into agricultural policy through administrative and technical channels, while Auvrignon (2024) shows that the *Projet Agroécologique pour la France* was built through a centralized process coordinated by agricultural agencies, ensuring coherence but limiting regional autonomy and grassroots experimentation. Clément et al. (2023) further demonstrate that advisory and support structures operate within hierarchical frameworks with limited flexibility to adapt to local contexts. Participation in national programmes such as the *GIEE* or *30 000 Fermes* mainly involves “virtuous farmers” – those already engaged in sustainability schemes or possessing greater institutional capital – thereby reproducing social selectivity and narrowing the diversity of actors represented in policy processes. This selective inclusion reinforces the technocratic orientation highlighted by the literature, where institutional legitimacy prevails over participatory diversity (Clément et al., 2023; Lamine et al., 2023). The limited outcomes of the *Ecophyto plan* and uneven

engagement in *GIEEs* illustrate the discrepancy between ambitious national rhetoric and practical implementation. Similarly, the *Environmental Vocabulary List* (2025), which standardized agroecology terminology across administrative frameworks, defines agroecology as “a set of agricultural practices that favor biological interactions and aim at the optimal use of the possibilities offered by agroecosystems,” focusing on efficiency and productivity while overlooking the social relations and governance arrangements central to systemic transformation. Overall, the French case illustrates that strong institutionalization does not necessarily entail systemic transformation. The analysis indicates that agroecology is embedded in national policy through coherent and stable state structures, but these remain centralized and procedural, prioritizing administrative coordination over participatory and deliberative governance.

Across the three countries, the findings reveal distinct yet converging trajectories. Portugal illustrates institutional fragility and local fragmentation, with agroecology largely confined to education, research, and municipal initiatives. Spain shows a more decentralized and participatory dynamic, where regional and local governments act as drivers of innovation, but the absence of coordination at the national level limits overall coherence. France, in contrast, displays strong institutionalization within a coherent state framework, yet governance remains technocratic and only partially participatory. Despite these differences, all three cases suggest that the systemic vision of agroecology – anchored in multi-actor participation, redistribution, and institutional redesign – remains only partially embedded in public policy. *Levels 3: Redesign* and *4: Reconnection* dominate, reflecting progress in ecological management, education, and local food systems, while *Level 5: System transformation* remains marginal, indicating that multi-actor and multi-level governance are still largely aspirational. Overall, these findings point to an institutionalization of agroecology in Mediterranean Europe that remains predominantly oriented towards incremental adaptation rather than systemic transformation.

V. CONCLUSION

This comparative analysis shows that the institutionalization of agroecology in Portugal, Spain, and France remains uneven and largely oriented towards incremental approaches. Most policy instruments are concentrated in Gliessman’s *Levels 3 and 4: agroecosystem redesign and reconnection* through education, training, and local food

systems – while *Level 5: system transformation*, which entails participatory and multi-level governance, remains marginal. The results highlight three distinct but related configurations: Portugal displays symbolic yet fragmented institutionalization; Spain advances through decentralized local initiatives with limited national coordination; and France presents strong institutional embedding within a technocratic and centralized framework.

This comparison yields key lessons for advancing systemic agroecological policies in Mediterranean Europe and offers recommendations that can inform Portugal and other countries with similar contexts. First, establishing a legal definition of agroecology may be an important step for policy coherence and institutional legitimacy, provided that it integrates ecological, social, and political understandings of transition. Second, stronger coordination is required between European, national, and regional levels to align the CAP and Green Deal frameworks with territorial strategies on soil, water, and climate resilience. Third, equity and inclusion should be enhanced by simplifying access to funds and recognizing small, family, and multifunctional farms as key actors. Fourth, participation must extend beyond already “virtuous” actors: broader dialogue among farmers, local authorities, researchers, and civil society is needed to reconnect production and consumption.

Governance emerges as a central gap in the agroecological transition. Policies describe what agroecology should achieve but rarely define how it should be governed. Strengthening participatory and accountable governance mechanisms is crucial to move from symbolic reference to systemic change. Future research should examine how education and knowledge co-creation can be embedded within participatory governance frameworks, and how territorial approaches can be scaled into national policy systems to consolidate agroecology as a systemic governance approach for Mediterranean food systems.

Funding

This work was supported by FCT - Fundação para a Ciência e Tecnologia, I.P. by project reference and DOI identifier https://doi.org/10.54499/UI/BD/153087/2022.

Acknowledgments

The authors thank the Portuguese Foundation for Science and Technology (FCT) for the financial support to the Research Centre for Natural Resources, Environment and

Society – CERNAS doi: 10.54499/UIDB/2020 and to the PAGE Project (Ref: RR-C05-i03-I-000217).

References

Antonelli, M., Basile, L., Gagliardi, F., & Isernia, P. (2022). The future of the Mediterranean agri-food systems: Trends and perspectives from a Delphi survey. *Land Use Policy, 120,* 106263. https://doi.org/10.1016/j.landusepol.2022.106263

Auvrignon, J. (2024). The institutionalization of agroecology through the Agroecological Project for France [Master's thesis, Lund University]. IIIEE. https://lup.lub.lu.se/student-papers/search/publication/9171345

Barral, S., & Detang-Dessendre, C. (2023). Reforming the Common Agricultural Policy (2023–2027): Multidisciplinary views. *Review of Agricultural, Food and Environmental Studies, 104*(1), 47–50. https://doi.org/10.1007/s41130-023-00191-9

Clément, C., Labarthe, P., & Plumecocq, G. (2023). The everyday work of farm advisors as interface bureaucrats in greening French agricultural policies. *Journal of Political Ecology, 30*(1), 894–916. https://doi.org/10.2458/jpe.5450

Costa-Pereira, I., Aguiar, A. A. R. M., Delgado, F., & Costa, C. A. (2025). Recognizing diversity to enable an agroecological transition: Understanding the potential of family farmers in Portugal. *Frontiers in Sustainable Food Systems – Agroecology and Ecosystem Services, 9,* 1604961. https://doi.org/10.3389/fsufs.2025.1604961

Cramer, W., Guiot, J., Fader, M., Garrabou, J., Gattuso, J. P., Iglesias, A., Lange, M. A., Lionello, P., Llasat, M. C., Paz, S., Peñuelas, J., Snoussi, M., Toreti, A., Tsimplis, M. N., & Xoplaki, E. (2018). Climate change and interconnected risks to sustainable development in the Mediterranean. *Nature Climate Change, 8*(11), 972–980. https://doi.org/10.1038/s41558-018-0299-2

Delgado, C. (2023). The role of land as the central piece to sustainable food systems: Lessons learned from Portugal's national food-related policies. *Geography and Sustainability, 4*(1), 84–90. https://doi.org/10.1016/j.geosus.2023.01.001

European Court of Auditors (ECA). (2024). Common Agricultural Policy Plans: Greener but not matching the EU's ambitions for the climate and the environment (Special Report 20/2024). Publications Office of the European Union. http://data.europa.eu/eli/C/2024/5766/oj

Espluga-Trenc, J., Calvet-Mir, L., López-García, D., Di Masso, M., Pomar, A., & Tendero, G. (2021). Local agri-food systems as a cultural heritage strategy to recover the sustainability of local communities: Insights from the Spanish case. *Sustainability, 13*(11), 6068. https://doi.org/10.3390/su13116068

Food and Agriculture Organization of the United Nations (FAO) & International Fund for Agricultural Development (IFAD). (2019). The future of family farming in the context of the 2030 Agenda.

https://www.ifad.org/documents/38714174/41167968/UNDFF+Background_Document.pdf/f8a7ed38-996b-96a8-9ab4-5c53ab0779f2

Gallardo-López, F., Hernández-Chontal, M. A., Cisneros-Saguilán, P., & Linares-Gabriel, A. (2018). Development of the concept of agroecology in Europe: A review. *Sustainability, 10*(4), 1210. https://doi.org/10.3390/su10041210

Gascuel-Odoux, C., Lescourret, F., Dedieu, B., Detang-Dessendre, C., Faverdin, F., Hazard, L., Litrico-Chiarelli, I., Petit, S., Roques, L., Reboud, X., Tixier-Boichard, M., de Vries, H., & Caquet, T. (2022). The Common Agricultural Policy and agroecological transition: Between incremental change and systemic transformation. *Agronomy for Sustainable Development, 42,* 53. https://doi.org/10.1007/s13593-022-00786-4

Gava, O., Povellato, A., Galioto, F., Prazan, J., Schwarz, G., Quero, A. L., Iragui, U. Y., Massa, C. A., Zilans, A., & Carolus, J. (2022). Policy instruments to support agroecological transitions in Europe. *EuroChoices, 21*(3), 13–20. https://doi.org/10.1111/1746-692X.12367

Gava, O., Vanni, F., Schwarz, G., Guisepelli, E., Vincent, A., Prazan, J., Rainer-Weisshaidinger, R., Frick, R., Hrabalová, A., Carolus, J., Iragui, Y. U., Pyysiäinen, J., Smyrniotopoulou, A., Vlahos, G., Balázs, K., Szilágyi, A. J., Jegelevičius, G., Mikšytė, E., Zilans, A., Frățilă, M., Röös, E., Miller, M., & Povellato, A. (2025). Governance networks for agroecology transitions in rural Europe. *Journal of Rural Studies, 114,* 103482. https://doi.org/10.1016/j.jrurstud.2024.103482

Geck, M. S., Crossland, M., & Lamanna, C. (2023). Measuring agroecology and its performance: An overview and critical discussion of existing tools and approaches. *Outlook on Agriculture, 52*(3), 349–359. https://doi.org/10.1177/00307270231196309

Giraldo, O., & Rosset, P. (2017). Agroecology as a territory in dispute: Between institutionality and social movements. *Journal of Peasant Studies, 45*(3), 545–564. https://doi.org/10.1080/03066150.2017.1353496

Gliessman, G. (2016). Transforming food systems with agroecology. *Agroecology and Sustainable Food Systems, 40*(3), 187–189. https://doi.org/10.1080/21683565.2015.1130765

González, R. A., Thomas, J., & Chang, M. (2018). Translating agroecology into policy: The case of France and the United Kingdom. *Sustainability, 10*(8), 2930. https://doi.org/10.3390/su10082930

Heyl, K., Döring, T., Garske, B., Stubenrauch, J., & Ekardt, F. (2020). The Common Agricultural Policy beyond 2020: A critical review in light of global environmental goals. *Review of European, Comparative & International Environmental Law, 30*(1), 95–106. https://doi.org/10.1111/reel.12351

Lamine, C., Pugliese, P., Barataud, F., Berti, G., & Rossi, A. (2023). Italian biodistricts and French territorial food projects: How science–policy–experience interplays shape the framings of transitions towards sustainable territorial food systems. *Frontiers in Sustainable Food Systems, 7,* 1223270. https://doi.org/10.3389/fsufs.2023.1223270

Lamine, C., Magda, D., & Darnhofer, I. (2024). Quelle pertinence de l'usage de la notion de résilience pour les systèmes agri-alimentaires? *Natures Sciences Sociétés, 32*(1), 90–97. https://doi.org/10.1051/nss/2024035

Langlais, A. (2023). The new Common Agricultural Policy: Reflecting an agro-ecological transition. *Review of Agricultural, Food and Environmental Studies, 104*(1), 51–66. https://doi.org/10.1007/s41130-022-00183-1

Lazoglou, G., Papadopoulos-Zachos, A., Georgiades, P., Zittis, G., Velikou, K., Manios, E. M., & Anagnostopoulou, C. (2024). Identification of climate change hotspots in the Mediterranean. *Scientific Reports, 14,* 29817. https://doi.org/10.1038/s41598-024-80139-1

Linares-Quero, A., Iragui Yoldi, U., Gava, O., Schwarz, G., Povellato, A., & Astrain, C. (2022). Assessment of the Common Agricultural Policy 2014–2020 in supporting agroecological transitions: A comparative study of 15 cases across Europe. *Sustainability, 14,* 9261. https://doi.org/10.3390/su14159261

López-García, D., & González de Molina, M. (2021). An operational approach to agroecology-based local agri-food systems. *Sustainability, 13*(15), 8443. https://doi.org/10.3390/su13158443

López-García, D., Vázquez-Macías, G., García-Fernández, J., Schmitt, M., Ortega-Faura, P., & Espluga-Trenc, J. L. (2023). Towards a politics of recognition: Exploring the symbolic contexts of material agroecological transitions. *Sustainability, 15,* 10091. https://doi.org/10.3390/su151310091

Lucas, V. (2021). A "silent" agroecology: The significance of unrecognized sociotechnical changes made by French farmers. *Review of Agricultural, Food and Environmental Studies, 102,* 1–23. https://doi.org/10.1007/s41130-021-00140-4

Márquez-Barrenechea, A., García-Llorente, M., López-Medellín, X., Llobera, F., & Redondo, M. (2020). How do policy-influential stakeholders from the Madrid region (Spain) understand and perceive the relevance of agroecology and the challenges for its regional implementation? *Journal of Sustainable Organic Agriculture Systems, 70*(2), 145–156. https://doi.org/10.3220/LBF1613665702000

Mediterranean Experts on Climate and Environmental Change (MedECC). (2020). Climate and environmental change in the Mediterranean Basin – Current situation and risks for the future. First Mediterranean assessment report (W. Cramer, J. Guiot, & K. Marini, Eds.). Union for the Mediterranean, Plan Bleu, UNEP/MAP. https://doi.org/10.5281/zenodo.4768833

Moeller, N. M., Geck, M., Anderson, C., Barahona, C., Broudic, C., Cluset, R., Henriques, G., Leippert, F., Mills, D., Minhaj, A., Mueting-van Loon, A., Piers de Raveschoot, S., & Frison, E. (2023). Measuring agroecology: Introducing a methodological framework and a community of practice approach. *Elementa: Science of the Anthropocene, 11*(1), 1. https://doi.org/10.1525/elementa.2023.00042

Pérez-Lucas, G., Navarro, S., & Navarro, G. (2024). Adapting agriculture and pesticide use in the Mediterranean to a changing climate. *Agronomy, 14*(6), 1458. https://doi.org/10.3390/agronomy14061458

Reboud, X., & Hainzelin, E. (2017). L'agroécologie, une discipline aux confins de la science et du politique. *Natures Sciences Sociétés, 25,* S64–S71. https://doi.org/10.1051/nss/2017036

Rivera-Ferre, M. G. (2018). The resignification process of agroecology: Competing narratives from governments, civil society and intergovernmental organizations. *Agroecology and Sustainable Food Systems.* https://doi.org/10.1080/21683565.2018.1437498

Soto, R. L., Oteros-Rozas, E., & Rivera-Ferre, M. (2024). Coexisting definitions of agroecology in Europe: Specificities and complementarities to scale agroecology up. In *Proceedings of the X International Congress of Agroecology* (pp. 561–567). ISBN 978-972-8765-51-4.

Viegas, M., Wolf, J., & Cordovil, F. (2023). Assessment of inequality in the Common Agricultural Policy in Portugal. *Agricultural and Food Economics, 11,* 13. https://doi.org/10.1186/s40100-023-00255-w

Viegas, M., Grilo, C., Pires, S., & Cordovil, F. (2024). Democratizar a Política Agrícola Comum em Portugal: O caso da Coligação Cívica Participar no PEPAC. *Análise Social, 255*, lx(2), e30832. https://doi.org/10.31447/30832

Wezel, A., Goette, J., Lagneaux, E., Passuello, G., Reisman, E., Rodier, C., & Turpin, G. (2018). Agroecology in Europe: Research, education, collective action networks, and alternative food systems. *Sustainability, 10*(4), 1214. https://doi.org/10.3390/su10041214

Article 4 | Co-designing policy levers for place-based agroecological transitions in Portugal

Costa-Pereira, I., Aguiar, A. A. R. M., Vicente, M. & Costa, C. A. Co-designing policy levers for place-based agroecological transitions in Portugal. Submitted (not yet published).

ANNEX 3 | Focus group guide

Co-designing policy levers for agroecological for place-based transitions in Portugal

Costa-Pereira, I.[1, 2]; Aguiar, A.[2]; Vicente, M.I [3,4], Costa, C.A.[1]

[1] Research Centre for Natural Resources, Environment and Society - CERNAS/IPV -Polytechnic Institute of Viseu, Viseu, Portugal

[2] GreenUPorto – Sustainable Agrifood Production Research Centre/Inov4Agro, DGAOT, Faculty of Sciences, University of Porto, Campus de Vairão, Rua da Agrária 747, 4485-646 Vairão, Portugal

[3] Ciência Viva - Agência Nacional para a Cultura Científica e Tecnológica, Lisboa, Portugal

[4] Centre for Functional Ecology—Science for People & the Planet (CFE), Associate Laboratory TERRA, University of Coimbra History, Territories and Communities, Faculty of Social Sciences and Humanities, NOVA University of Lisbon,1069-061 Lisbon, Portugal

ABSTRACT: Agroecology is increasingly referenced in European and national policy agendas, yet its translation into actionable and territorially grounded transition pathways remains uneven. This article examines how food-system actors in three Portuguese territories (Tavira, Lisbon and Viseu), characterised by distinct geographic and urban–rural profiles, understand agroecological transitions and identify priorities, recommendations and implementation instruments to support them. The study draws on three mixed multi-actor focus groups (n=29) using a shared co-design sequence combining food-system diagramming, deliberation and individual prioritisation exercises. Materials were analysed through inductive qualitative coding, thematic synthesis and supplementary keyword-frequency counts. Findings show that participants framed agroecological transition as a food-system process rather than a farm-level technical adjustment. Across territories, participants converged around education and food-literacy measures, governance coordination, and market and procurement arrangements as key enabling dimensions for agroecological transition. Proposed measures included curricular integration, experiential learning and vocational training, alongside multi-actor coordination mechanisms such as support networks, local councils and municipal food initiatives. At the same time, proposed instruments varied according to territorial vulnerabilities and implementation constraints, particularly regarding public procurement, fiscal incentives, land and water governance, and advisory and demonstration infrastructures. The findings suggest that agroecological transition policies are more likely to become operational when designed as place-based policy packages combining

shared enabling infrastructures with context-specific instruments adapted to territorial conditions and implementation constraints.

Keywords: Agroecological transition; Food system governance; Co-design; Policy levers; Portugal

I. Introduction

Agroecology has gained increasing visibility within scientific, political and institutional agendas in recent decades (Giraldo & Rosset, 2017; Rivera-Ferre, 2018; Rosset & Altieri, 2021; Prost et al., 2023). While commonly defined as the application of ecological principles to the design and management of sustainable food systems integrating ecological and social dimensions (Rivera-Ferre, 2018), agroecology has increasingly been framed as a broader process of transformation involving farming and food systems embedded in wider socio-technical dynamics (Prost *et al*., 2023). This institutional mainstreaming has, however, intensified disputes over the meaning and political orientation of agroecology (Giraldo & Rosset, 2017; Rivera-Ferre, 2018). In policy contexts, agroecology is frequently disaggregated into separable dimensions — such as “science”, “practice” and “movement” — which may facilitate its reduction to technical or farm-level interventions compatible with dominant agri-food systems, rather than a systemic transformation of food systems and governance arrangements (Giraldo & Rosset, 2017; Rivera-Ferre, 2018; Rosset & Altieri, 2021). In contrast, agroecological approaches rooted in food sovereignty perspectives emphasize structural change, power relations and the co-creation of situated knowledge through participatory and horizontal processes involving farmers, researchers and other food system actors (Giraldo & Rosset, 2017; Prost *et al*., 2023; Cartagena *et al.,* 2025).

Despite growing attention to agroecological transitions in Europe, comparatively less attention has been paid to how food-system actors across different territorial contexts prioritise transition needs, governance arrangements and implementation instruments in practice. Existing evidence points to uneven institutionalisation and operationalisation across countries, policy domains and territorial contexts (Wezel *et al*., 2018; Gava *et al*., 2022; Linares-Quero *et al.,* 2022). Policy support has often remained concentrated on incremental measures, such as knowledge exchange, advisory support, agri-environmental schemes, organic farming incentives, cooperation measures and short supply-chain initiatives, while deeper changes in governance, redistribution, territorial coordination and food-system redesign remain more limited (Gava *et al*., 2022; Linares-

Quero *et al.,* 2022). This unevenness reflects not only differences in policy design, but also the fact that agroecological transitions are embedded in wider socio-technical systems and are shaped by context-specific barriers, including institutional fragmentation, unequal access to support, weak coordination, market constraints and limited recognition of differentiated transition pathways (Gava *et al*., 2022; Prost *et al*., 2023).

At the European Union level, the policy environment for agricultural sustainability transitions has been increasingly framed by the European Green Deal and the Farm to Fork Strategy, while their main agricultural implementation mechanism remains the 2023–2027 Common Agricultural Policy (CAP) and its new delivery model based on national CAP Strategic Plans (Barral & Detang-Dessendre, 2023; Langlais, 2023). The reform combines stronger subsidiarity with an explicit “greening” ambition, particularly through eco-schemes financed under Pillar I, but has also been criticised for its complexity and for the limited transformative scope of many proposed measures relative to Green Deal ambitions (Barral & Detang-Dessendre, 2023). Moreover, the CAP reform frames its objectives primarily in terms of a “transition to sustainable agriculture”, without explicitly defining agroecological transition as a policy objective, thereby leaving the direction and depth of transformation open to competing interpretations and policy pathways (Langlais, 2023).

Research on agroecological transitions in Europe argues that moving beyond incremental change requires more than the diffusion of isolated technical practices at farm level. Instead, agroecological transitions are increasingly conceptualised as systemic and context-dependent transformation processes involving farming systems, food systems, governance arrangements and socio-technical dynamics across multiple scales (Gascuel-Odoux *et al.,* 2022; Prost *et al*., 2023; Gava *et al*., 2025; Ujj *et al*., 2025). This literature highlights the importance of participatory knowledge processes, territorial coordination, governance networks and differentiated transition trajectories adapted to diverse farming and local contexts, rather than uniform “best-practice” approaches alone (Costa-Pereira *et al*., 2025; Gava *et al*., 2025; Ujj *et al*., 2025). At the same time, analyses of post-2022 CAP reform debates suggest that transformative ambitions have often been diluted through fragmented governance arrangements, institutional interaction patterns, technical policy language and unequal power relations that reinforce existing agri-food configurations and constrain the inclusion of alternative actors and meanings within policymaking processes (Hepping *et al*., 2025). Consequently, the effectiveness of policies supporting agroecological transitions depends not only on the design of policy instruments themselves, but also on governance arrangements capable of enabling

inclusive, place-based and participatory processes that address contextual diversity and power asymmetries in decision-making (Anderson *et al*., 2019; Costa-Pereira *et al*., 2025; Gava *et al.,* 2025).

Within this broader European context, Portugal has been characterised by fragmented and uneven processes of agroecological institutionalisation. Comparative analyses suggest that agroecology has become more consolidated as a scientific and educational domain than as a coherent policy framework or organised political movement (Gallardo-López *et al*., 2018). Existing evidence suggests that agroecological initiatives remain strongly locally anchored and are advanced through a combination of research and educational activities, municipal initiatives, grassroots networks and a relatively limited set of public policy instruments and institutional structures (Costa-Pereira *et al*., under review; Ujj et al., 2025). At the same time, these initiatives continue to face persistent coordination, implementation and resourcing challenges, reflecting broader institutional fragmentation and uneven governance support for agroecological transitions (Delgado, 2023; Ujj *et al.,* 2025).

At the food-system governance level, Portuguese food-related policies have been described as largely sectoral and insufficiently integrated across domains such as agriculture, food, land governance and territorial planning. While municipal engagement with food-system issues has expanded in recent years, local initiatives are frequently developed in dispersed and weakly articulated ways, often in the absence of a coherent national strategy linking sustainability, food justice and territorial governance objectives (Calvário & Castro, 2022; Delgado, 2023). These governance limitations intersect with broader CAP-related dynamics. Empirical analyses show that CAP payment distribution in Portugal remains highly concentrated and excludes a substantial share of small-scale farms (Viegas *et al*., 2023). In parallel, assessments of the Portuguese CAP Strategic Plan (PEPAC) process have highlighted asymmetries in participation and consultation, with established agricultural organisations maintaining greater influence relative to civil-society actors (Viegas *et al*., 2025).

Existing research further suggests that current policy frameworks tend to structurally disadvantage small and diversified family farms while inadequately recognising the diversity of agroecological transition pathways across territories and farming systems (Costa-Pereira *et al*., 2025). Rather than assuming uniform transition trajectories, recent studies emphasise the importance of differentiated and place-sensitive public policies capable of addressing diverse territorial conditions, farming realities and governance contexts (Costa-Pereira *et al*., 2025; Ujj *et al*., 2025). Against this backdrop, there

remains limited empirical understanding of how different food-system actors across contrasting territorial contexts prioritise governance needs, policy recommendations and transition instruments for agroecological transitions in Portugal. Examining these perspectives may therefore contribute to identifying territorially grounded policy priorities and support mechanisms for agroecological transitions.

To contribute to this gap, this article addresses the following research question: *How do different food-system actors across three Portuguese territories envision agroecological transition processes, and which priorities and policy instruments do they identify as necessary to support them*? It draws on perspectives from actors engaged in the food system in Tavira (southern coastal), Lisbon (metropolitan) and Viseu (inland central-northern), exploring both shared and territory-specific understandings of constraints, opportunities and support mechanisms. Using mixed multi-actor focus groups and a participatory sequence involving deliberation and individual prioritisation exercises, the article analyses convergences and divergences in transition priorities, proposed recommendations and policy instruments across territories. The article then discusses the implications of these findings for place-based and territorially grounded approaches to agroecological transition governance, particularly regarding multi-actor coordination, differentiated policy needs and territorially adapted transition support.

II. Methodology

2.1. Mixed focus groups

Addressing agroecological transitions as systemic and place-specific processes involving ecological dynamics, social relations, governance arrangements and power relations requires approaches capable of capturing interaction across diverse actor positions and forms of situated knowledge (Lang *et al*., 2012; Anderson *et al*., 2019). This aligns with broader shifts in agricultural innovation and transition research away from linear models of knowledge transfer towards more interactive and multi-actor approaches centred on exchange, co-learning and the integration of heterogeneous forms of expertise and experience (Feo, 2022).

Mixed focus groups provide a setting in which data are generated through participant interaction and where actors occupying different food-system roles can articulate barriers, coordination challenges, conflicting priorities and shared concerns emerging

across the food system (Morgan, 2013; Krueger & Casey, 2015; Magalhães et al., 2022; Chiarella et al., 2023). Rather than seeking consensus, such interaction allows participants to compare experiences, challenge assumptions and expose convergences, tensions and contrasting framings of transition processes and policy responses (Krueger & Casey, 2015; Magalhães *et al*., 2022; Manzano, 2022). In this study, mixed focus groups brought together actors involved in different dimensions of the food system — including farmers, consumers, technicians, civil-society representatives and public officials — in order to examine how agroecological transition needs and policy priorities were understood across interconnected domains such as production, consumption, markets and governance (Manzano, 2022; Chiarella *et al*., 2023).

Because mixed groups involve participants with different forms of expertise, institutional positions and levels of authority, their use also requires attention to potential asymmetries in participation and influence (Krueger & Casey, 2015; Magalhães *et al*., 2022; Manzano, 2022). Accordingly, focus-group design and facilitation sought to support participation across actors and a structured interaction among them through facilitated discussion and the use of shared visual supports and elicitation tools during group activities (Lang *et al.,* 2012; Feo, 2022). This approach aimed to create conditions for participants to collectively identify and discuss transition priorities, governance challenges and policy support needs across different territorial and food-system contexts.

2.2. Participant selection

Study territories were selected to capture contrasting Portuguese food-system contexts and governance settings, enabling cross-territorial comparison of how different actors frame agroecological transitions and identify policy priorities and support needs. Viseu represents a central inland context characterised by mountainous environments and more rural settlement patterns; Lisbon a metropolitan context marked by strong urban concentration and a service-based profile; and Tavira a southern coastal context in the Algarve shaped by coast–inland dynamics and tourism-related pressures (Arroteia, 2023). For readability, territories are referred to by case-study name, with broader territorial location (south/metropolitan/inland centre-north) indicated at first mention.

Participant selection was structured through an actor matrix inspired by Gliessman's (2016) five levels of food-system transformation. The framework distinguishes between incremental adjustments within conventional systems (Levels 1–2), agroecosystem

redesign (Level 3), the reconnection of producers and consumers and territorial food-system restructuring (Level 4), and broader food-system transformation involving governance, participation and institutional change (Level 5). In this study, the matrix was used as a heuristic tool to support diversity in participant selection across food-system functions, forms of knowledge and governance roles, rather than as a rigid classification of actors. Recruitment prioritised actors whose main activities were primarily associated with Levels 3–5, reflecting the study's focus on agroecological redesign, reconnection and wider food-system transformation processes. Levels were operationalised through broad activity domains represented in the matrix, including agroecological production practices and ecological management (Level 3), local food systems, distribution, food-system connectivity, knowledge exchange and circular-economy initiatives (Level 4), and institutional action, participatory governance, food sovereignty and collective-resource management (Level 5).

The matrix was used to identify actors occupying different positions within the food system and involved in different dimensions of agroecological transition processes. Participants included farmers and producers, distributors and food-related businesses, cooperative and association representatives, researchers and educators, public officials and municipal actors, health-related participants, and civil-society and consumer representatives. Participants were positioned within Levels 3–5 according to the main orientation of their activities within the context of the study, while recognising that many actors operated across multiple dimensions of food-system activity and could potentially relate to more than one transition level. The objective was therefore not statistical or sectoral representativeness, but the inclusion of heterogeneous actor positions relevant to agroecological transition processes and food-system governance across territories. Consistent with qualitative and multi-actor approaches in agroecology research (Lang *et al.*, 2012; Feo, 2022), participants were recruited through purposive and snowball sampling, starting from agroecology-related networks in each territory and asking initial contacts to suggest additional actors and initiatives relevant to the study focus. Participation was voluntary and based on prior information regarding the objectives and intended use of the study. Sessions were held in non-academic venues to support accessible and discussion-oriented group environments.

2.3. Session procedure and guiding framework.

The three focus groups followed a common guide developed for this study. The guide structured a participatory and multi-actor discussion process involving non-academic

actors and a sequence of interactive steps moving from problem identification to recommendations and implementation instruments. Table 1 summarises the session blocks, guiding questions and indicative timing. Sessions were scheduled for three hours, with timings treated as indicative to allow introductions, transitions, plenary discussion, and handling of written and visual materials, consistent with guidance to adapt focus group duration when additional structured activities are included (Morgan, 2013; Krueger & Casey, 2015).

Block	Guiding questions / activity	Indicative time
Opening	Welcome, consent, icebreaker, research context	30 min
Step 1	"Which parts of the food system require the most urgent action for the agroecological transition?" (small groups + plenary sharing)	20 min
Step 2	"Which two or three recommendations would you prioritise for the agroecological transition?" (post-its on diagram)	20 min
Step 3	"Which instruments could make these recommendations a reality?" (post-its on diagram)	20 min
Step 4	Review, complementarities/tensions and voting the recommendations/instruments considered more important for advancing an agroecological transition (up to two votes per participant)	10 min
Closing	Wrap-up and next steps	5 min

Table 1 |- Session blocks, guiding questions and indicative timing (focus group guide)

The deliberative sequence moved from the identification of urgent areas for action to recommendations and implementation instruments. Step 1 elicited a system-wide framing of priorities by asking participants which parts of the food system required the most urgent action to support an agroecological transition. Steps 2 and 3 then differentiated between two distinct outputs explicitly defined during the sessions. First, participants formulated policy recommendations as strategic and political-level guiding lines expressing what should be done and why, translating priorities, principles and objectives without specifying implementation mechanisms. Second, participants identified implementation instruments as the concrete tools and operational mechanisms that could support the implementation of those recommendations, including examples such as incentives, training, certification, local markets, public procurement and support networks. This sequence aimed to distinguish between the identification of priorities and

directions for policy action (“what should change”) and the discussion of operational mechanisms (“how change could be supported”).

Before the deliberative activities, participants were provided with a brief presentation intended to provide a shared discussion basis and contextual orientation for the session. The presentation summarised (i) a typology of Portuguese family farmers and transition trajectories developed in a farm-level analysis (Costa-Pereira *et al.,* 2025) and (ii) key findings from a comparative analysis of agroecology-related policy instruments and expert consultation (Costa-Pereira *et al*., under review). The presentation also introduced the food-system perspective used in the study. The purpose was to support a shared starting point and common language across participants from different backgrounds, while recognising that prior framing may influence deliberation and discussion dynamics.

An A1 food-system diagram adapted from Parsons *et al*. (2019) was displayed throughout the session as a shared visual support (Fig. 1), centring the food supply chain and highlighting interdependencies with political, health, environmental, social and economic dimensions. The diagram functioned as a common reference framework to support discussion across different food-system domains and to spatially locate priorities, recommendations and instruments during the session activities.

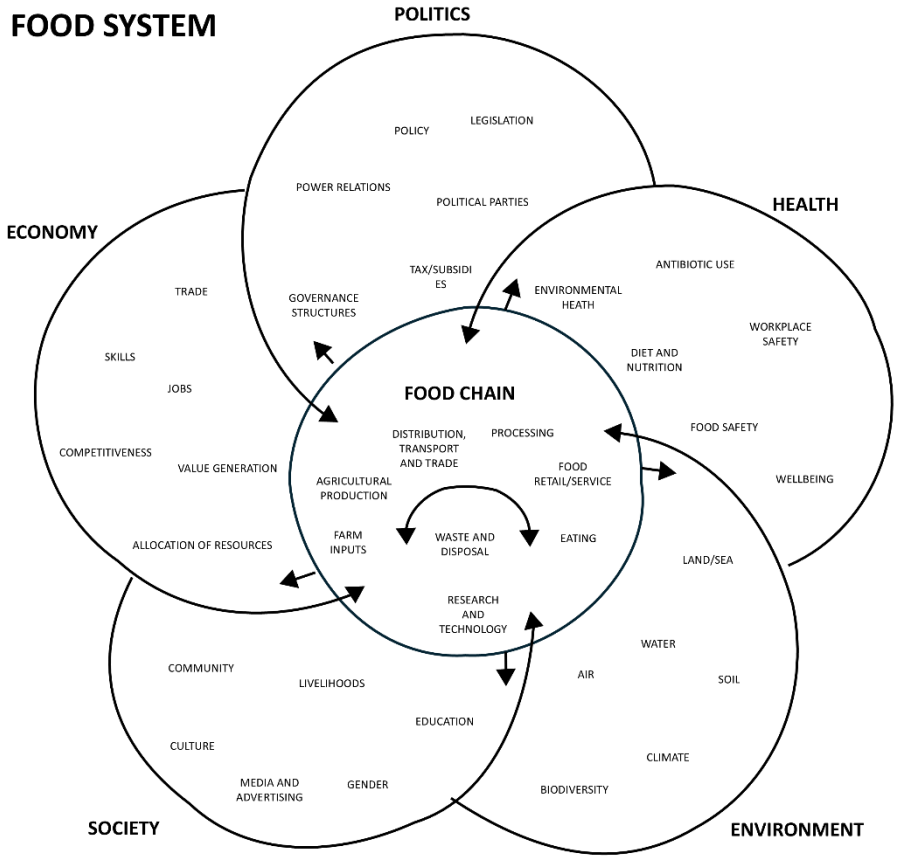


Figure 1 | The food supply chain is at the core of the food system and has interdependencies with politics, health, environment, society and economy

To support open debate in mixed groups and reduce moderator effects, sessions were moderated by an experienced facilitator external to the research team. The team took systematic notes, and discussions were audio-recorded with informed consent. The moderator posed questions, kept discussion on track, and encouraged participation across participants with different backgrounds and institutional positions (Krueger & Casey, 2015). Given the mixed-group composition, facilitation paid particular attention to power dynamics, potential dominance effects and the expression of contrasting perspectives during discussion.

Across Steps 1–3, participants discussed each step first in small groups (10 min) and then in plenary (10 min). Recommendations and instruments were written on colour-coded post-its (one colour for recommendations, another for instruments) and placed on the corresponding areas of the food-system diagram; a third colour marked items selected in the final vote. The final stage also included a brief discussion of complementarities and tensions between recommendations before individual prioritisation. For final voting, each participant received two markers, allocated next to

selected post-its on the diagram; votes were then counted and recorded by the research team.

This structured design supported comparability across territories while also allowing context-specific priorities, tensions and interpretations to emerge during discussion, aligning with approaches that combine visual tools, written inputs and moderated discussion to support individual reflection and collective interpretation in multi-actor settings (Lang *et al*., 2012; Iocola *et al*., 2023).

2.4. Content analysis

A qualitative approach using primarily inductive coding and thematic synthesis was applied to materials generated in the focus groups (audio transcripts, annotated food-system diagrams and notes). Excerpts were translated from Portuguese. Quotations are drawn from the small-group ("table") syntheses produced in each step and reported in plenary; for Questions 2–3, excerpts reflect the written post-its and associated small-group syntheses discussed in plenary.

The analytic workflow followed an iterative first- and second-cycle coding logic with progressive development and refinement of categories and themes through repeated comparison across focus groups and discussion materials (Saldaña, 2013). The process comprised several iterative steps:

1. **Transcription and familiarisation.** Audio recordings were transcribed verbatim and reviewed alongside notes and the large-scale food-system diagrams produced during sessions, ensuring accuracy and supporting initial familiarisation with each focus group's content.

2. **First-cycle coding**. Transcripts were coded by the research team in AIQDA (a web-based qualitative data analysis platform) using a primarily inductive, line-by-line approach. Short descriptive codes, kept close to participants' language, captured ideas, concerns and proposed measures linked to the three guiding questions ("urgent parts of the food system", "priority recommendations" and "instruments").

3. **Second-cycle coding and categorisation**. Initial codes were reviewed, condensed and organised into broader topical categories through second-cycle coding, clustering related codes under common descriptive labels (e.g.,

education, public procurement, land access, water-related vulnerabilities, health) while retaining close connection to the meaning and context of the original discussion segments.

4. **Thematic synthesis and cross-territorial comparison**. Categories were compared and consolidated into higher-level themes and sub-themes; overlapping categories were merged or refined to reflect recurrent patterns across questions and focus groups. The resulting thematic patterns were then compared across Tavira, Lisbon and Viseu to examine urgent areas of intervention, priority recommendations and relevant instruments, highlighting shared concerns, contrasting emphases and territorial specificities.

To complement the qualitative interpretation with supplementary descriptive indications of lexical salience, keyword-frequency counts were conducted for each question and territory. For each thematic category, we compiled Portuguese keywords and expressions and implemented them as regular-expression patterns. Pattern occurrences were counted in cleaned text corpora for Questions 1–3 using a Python script; the script and regex patterns will be made available in the replication package upon acceptance. Counts reflect occurrences of keyword patterns in the text (not coded segments or participants), and categories were not treated as mutually exclusive. Frequency outputs were used only as supplementary descriptive indicators alongside the qualitative analysis, and not as measures of thematic importance or for statistical inference.

2.5. Ethical procedures

The research protocol, including the focus group guide, was reviewed and approved by the Ethics Committee of the Polytechnic Institute of Viseu (Protocol code n.º 38/SUB/2025, approved on 18/09/2025). All participants received clear information about the study's aims, methods and data use and provided informed consent for audio recording and the use of visual materials. The study followed principles of confidentiality, voluntary participation and the right to withdraw at any time. Data were anonymised and identifying details removed from transcripts and visual materials. Audio files and transcripts were stored on password-protected, access-restricted devices (encrypted where applicable), and consent forms were stored separately from the research data; access to raw data was limited to the research team. Data will not be shared publicly, audio recordings will be deleted after analysis, and consent forms will be destroyed at the end of the research.

2.6. Study limitations

While the approach emphasised depth and contextual richness, limitations should be noted. The small number of focus groups and the use of purposive and snowball sampling mean some perspectives are likely underrepresented, particularly actors less connected to agroecology-related networks or more strongly associated with Levels 1–2 of Gliessman's framework. The study therefore does not aim for statistical or sectoral representativeness. Although the participant matrix was organised around Levels 3–5, many participants operated across multiple transition levels simultaneously, meaning these categories should be understood as heuristic orientations rather than fixed classifications. Differences in institutional position and familiarity with policy processes may also have influenced participation dynamics within mixed groups. Finally, the use of predefined guiding questions and introductory contextual material supported comparability across territories but may also have influenced how priorities and governance issues were articulated during discussion.

III. Results

The three mixed focus groups were held between 29 October and 4 November 2025 and involved 7 participants in Tavira, 10 in Lisbon and 12 in Viseu (Table 2). The results are presented according to the three stages of the focus-group protocol. Section 3.1 reports perceived areas of urgency in the food system (Question 1). Section 3.2 presents priority recommendations and implementation instruments (Questions 2 and 3), distinguishing strategic directions from operational mechanisms. Section 3.3 reports the individual voting exercise, indicating which recommendations or instruments participants prioritised at the end of each session. This structure preserves the distinction between diagnostic priorities, policy recommendations and implementation instruments used during the focus groups. Quotations are attributed to the participant reporting the small-group synthesis in plenary, using actor profile and age group.

Territory		**Number of participants**		
		Tavira	**Lisbon**	**Viseu**
Participants	total number	7	10	12
Gender	men	3	7	4

	women	4	3	8
Age groups	18-30	1	2	3
	31-55	5	5	7
	56-70	1	3	2
Actor categories represented	Public administration/policy	1	1	2
	Education/academia	0	2	2
	Producers/processing	2	2	3
	Associations/NGO/enterprises	2	2	1
	Health/care	1	1	2
	Civil society/consumer	1	2	2
Transition levels represented	Level 3	2	3	4
	Level 4	3	3	4
	Level 5	2	4	4

Table 2 | Characteristics of the three mixed focus groups (territory, number of participants, gender, age groups, actor categories and transition levels represented).

Figure 2 (a–c) shows the annotated food-system diagrams produced in each session. Across territories, contributions spanned all major food-system domains and the food supply chain, supporting comparability while highlighting territory-specific concentrations. The three cases: Tavira (southern coastal), Lisbon (metropolitan) and Viseu (inland central-northern), were used to examine how problem framings, priorities and proposed instruments vary across settings using the same facilitated co-design sequence.

Figure 2 | Annotated food system diagrams produced during the mixed focus groups: (a) Tavira; (b) Lisbon; (c) Viseu.

3.1. Question 1: Parts of the food system that require urgent action for an agroecological transition

Across territories, participants framed “urgency” around four themes: (i) biophysical and territorial vulnerability; (ii) education and food literacy; (iii) knowledge and research; and (iv) policies, markets and distribution structures. Figures 3 and 4 summarise cross-territorial patterns using coded-content distributions (Fig. 3) and keyword-frequency counts as descriptive indicators (Fig. 4). Education-related terms are more frequent in Tavira and Viseu, biophysical terms (climate and water) are most prominent in Tavira, and Lisbon shows a more even distribution across themes. These patterns suggest that participants framed urgency not only in ecological terms, but also through educational, institutional and market-related dimensions of food-system transformation.

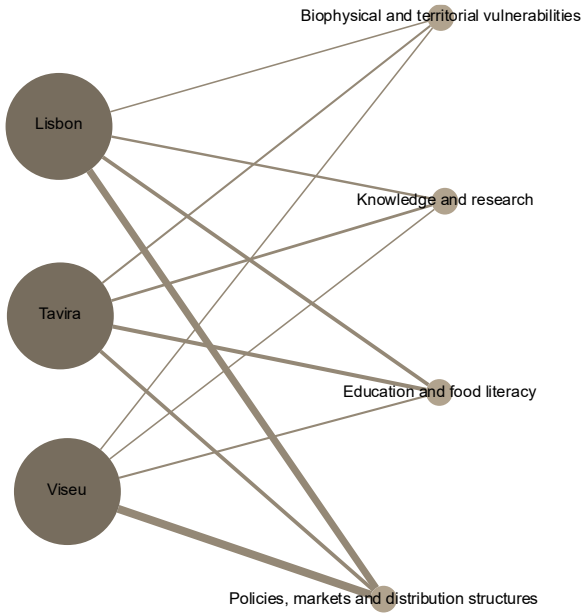


Figure 3 | Bipartite network linking territories (Lisbon, Tavira, Viseu) and themes identified in Question 1. Nodes represent territories (left) and thematic areas (right); edges indicate themes mentioned in each territory. Edge thickness is proportional to the number of coded segments (weight) for that theme in the corresponding territory; here, the thickest edges correspond to policy-related mentions in Lisbon and Viseu and education-related mentions in Tavira.

	TAVIRA	LISBON	VISEU
Biophysical and territorial vulnerabilities	25	18	9
Education and food literacy	46	18	35
Knowledge and research	18	13	7
Policies, markets and distribution structures	14	17	17

Figure 4 | Heatmap of keyword-occurrence counts by theme and territory (Question 1). Cells report occurrences of predefined keyword patterns in each territory’s Question 1 corpus, aggregated by thematic category; colour intensity indicates higher lexical frequency.

(i) Biophysical and territorial vulnerabilities. Across territories, biophysical conditions were framed as urgent constraints for agroecological transition, although priorities differed by territorial context. Tavira showed the highest incidence of coded segments in this theme (Fig. 3), with discussion focusing on water scarcity, increasing aridity and the need to strengthen rainfed systems and traditional species. "*We have to find ways to produce food under harsher conditions (…) much more based on rainfed systems and traditional species than on irrigation*." (Tavira, farmers' association, man, aged 56–70). In Lisbon, urgency centred on soil as the ecological basis of food production, while in Viseu participants associated vulnerability with land abandonment and the need to reactivate unused land through production initiatives.

(ii) Education and food literacy. Across territories, education was framed as an urgent area for agroecological transition, particularly in relation to rebuilding connections between people, food and land-based practices. Education-related coded segments were most frequent in Tavira and Viseu (Fig. 3), although emphases differed across territories. In Tavira, participants stressed early childhood and outdoor learning: "*It's about educating children from an early age (…) not in a classroom-outside the classroom*." (Tavira, parents' association, woman, aged 31–55) while in Viseu education was associated with reconnecting younger generations with land-based knowledge and practices. "*We have to pull them back to the land, to the things of the land*." (Viseu, teacher, woman, aged 56–70). In Lisbon, urgency centred on consumer education across generations.

(iii) Knowledge and research. Across territories, participants identified knowledge and research capacity as important enabling conditions for agroecological transition. Although less frequent overall, knowledge- and research-related coded segments appeared across all territories and were most prominent in Tavira and Lisbon (Fig. 3). In both Tavira and Viseu, participants emphasised the importance of scientific knowledge, research and technical support for informing policy decisions and supporting agroecological practices. In Viseu, participants also stressed the role of academic knowledge in legitimising decisions and addressing misinformation. In Lisbon, discussion placed greater emphasis on piloting, monitoring and scaling policy initiatives: "*A solution for developing policy is to run a pilot in a smaller territory and (…) monitor and evaluate, then scale."* (Lisbon, academia, woman, aged 31–55).

(iv) Policies, markets and distribution structures. Across territories, participants identified policies, markets and distribution structures as important areas requiring change, particularly regarding support schemes, market access and producer–consumer relations. Policy- and market-related coded segments were most frequent in Lisbon and Viseu (Fig. 3). In Lisbon, discussion focused on distribution and the need to strengthen proximity relations between producers and consumers beyond niche circuits. "*it was very important to break the chains a bit, and farmers should try to get closer to consumers*." (Lisbon, teacher, man, aged 56–70). Viseu participants emphasised the concentration of retail power and its effects on local markets and family farming recognition: "*Large multinationals (…) dominate 70–80% of retail trade (…) and that prevents producer–consumer proximity*." (Viseu, farmers' association, man, aged 31–55). In Tavira, discussion focused on support schemes perceived as penalising diversified and agroecological practices and favouring intensive or monoculture-oriented models, alongside calls to better align policy design with local realities (e.g., short supply chains and territorial needs).

3.2. Questions 2 and 3: Priority recommendations and instruments for an agroecological transition

Questions 2 and 3 focused on proposed responses to the priorities identified in Question 1. Recommendations were framed as strategic directions, while instruments referred to concrete mechanisms for implementation. The resulting material was organised into six thematic areas covering health, education, knowledge and training, markets and public procurement, land and territorial planning, and economic viability. Across territories, similar thematic concerns emerged, but proposed implementation instruments varied according to territorial conditions and perceived governance constraints. Table 3 presents illustrative excerpts by theme, question type and coding label.

(i) **Health, right to food and healthy diets.** This theme focused on rights-based framings linking healthy diets and food access to public responsibility, alongside proposals for multi-sector governance involving health actors. No segments were coded under this theme in Tavira.

(ii) **Education, food literacy and intergenerational learning.** Across territories, recommendations and instruments in this theme focused on experiential and intergenerational learning beyond formal schooling, including structured planning across

school levels, learning-by-doing approaches (including dedicated budgets), and curricular integration across educational pathways.

(iii) **Knowledge, research, training and technical support.** Knowledge infrastructures were framed as enabling conditions for implementation, including investment in research and professional training, piloting and scaling initiatives, municipal capacity, and advisory and practice-support mechanisms.

(iv) **Markets, public procurement and short supply chains.** Recommendations stressed proximity markets and commercialisation channels, while instruments centred on public procurement (notably school meals), supply organisation for institutional catering, and reforms to strengthen local market access and public procurement processes.

(v) **Land, water and territorial planning.** This theme combined land and water management with territorial planning and local governance arrangements. Recommendations included water-capture measures and land-access concerns, while instruments referred to land-cadastre clarification and municipal-backed multi-actor governance spaces.

(vi) **Economic viability and rural development.** Across territories, transition feasibility was linked to economic viability and to mechanisms conferring recognition and market visibility (e.g., labels, procurement scoring rules and support schemes). Instruments focused on continuity of support for territorial projects, adjustments to procurement rules, and support directed towards sustainable family farming and recognition mechanisms.

Theme	Question	Coding label	Excerpts
(1) Health, right to food and healthy diets	Recommendations	Frame healthy diets as a right and food as a public service	*"A balanced and sustainable diet (…) should be understood as a right (…) food as a public service that everyone must be able to access*." (Lisbon, civil society, man, aged 31-55)
		Integrate health actors in multi-sector governance	"*These multi-actor, multi-sector spaces must include health, education and agriculture*." (Viseu, civil society, woman, aged 31-55)
	Instruments	Municipal, multidisciplinary food projects, piloting and scaling	*"There should be multidisciplinary municipal food projects to guarantee the right to food (…) running pilot projects and then scaling to the regional level*." (Lisbon, public administration, woman, aged 31-55)
(2) Education, food literacy and intergenerational learning	Recommendations	Create structured education plans combining theory and practice	"*Create a strategic plan for education from pre-school to secondary school (…) with theory and practice.*" (Tavira, parents' association, woman, aged 31-55)
		Strengthen intergenerational public education	"*Strengthen public education for intergenerational sharing (…) learning throughout life*." (Lisbon, health care, woman, aged 31-55)
		Embed agroecology/agri-food topics in education pathways	*"We should include agri-food and agroecology topics in the educational programme up to secondary school*." (Viseu, health care student, man, aged 18-30)
	Instruments	Vocational training with field-based components and internships	"*Create agricultural vocational courses (…) with a strong field component: internships on the ground*." (Lisbon, health care, woman, aged 31-55)

		Dedicated school budgets for farm visits and school gardens	*"Allocate a budget to schools (…) so they must take students to farms (…) and then create their own school garden*." (Lisbon, producer, man, aged 18-30)
		Curricular integration from basic to secondary education	"*Integrate areas on agroecology in the curriculum from basic education to secondary education.*" (Viseu, health care student, man, aged 18-30)
(3) Knowledge, research, training and technical support	Recommendations	Invest in research	"*We need research and technology to change things: whether in Parliament or at the municipal level. (…) Measures are only taken when there is a research base*." (Tavira, processing sector, man, aged 18-30)
		Produce data on costs/benefits across budgets	"*Produce data and evidence on the costs and benefits of the agroecological transition across ministerial budgets*." (Lisbon, certification enterprise, man, aged 18-30)
		Knowledge and practice support as a prerequisite	"*To make the agroecological transition, people need to know what agroecological practices are and need support at that level*." (Viseu, civil society, woman, aged 31-55)
	Instruments	Cross-sector professional training (agriculture, environment, water, energy)	*"A training course for professionals covering agricultural, environmental, water and energy areas*." (Tavira, parents' association, woman, aged 31-55)
		Multidisciplinary municipal teams, pilots and scaling	"*Municipal food strategies should have multidisciplinary teams (…) running pilots and then scaling*." (Lisbon, public administration, woman, aged 31-55)
		Innovation hubs and demonstration fields linked to the territory	"*Innovation hubs (…) should provide demonstration fields for these practices and connect these experimental fields to the territory*." (Viseu, public administration, man, aged 56-70)
(4) Markets, public procurement and short supply chains	Recommendations	Reactivate proximity markets	*"Reactivate proximity markets. (…) While the parish council and, in some way, the municipality promoted it (…) it was always full; when they stopped doing so, it dwindled. This needs to be addressed."* (Lisbon, producer, man, aged 18–30). *"They are attractive markets, diverse (…) If we build on this, we are combating the depopulation of the interior. The market brings tourists."* (Lisbon, agricultural consultancy company, man, aged 56–70)
		Promote marketing circuits/channels	"*Then there is the marketing issue: promoting circuits and channels to bring these products to market.*" (Viseu, civil society, woman, aged 31-55)
	Instruments	Integrate local products in school meals via producer cooperatives	"*School meals should include local products (…) through cooperatives of producers. (...) in the specifications we can require that x% of food are of local origin*." (Tavira, parents' association, woman, aged 31-55)
		Scale procurement beyond schools, contingent on supply capacity	"*Not only school canteens, but also ministries have many canteens (…) and that requires supply capacity*." (Lisbon, teacher, man, aged 56-70)
		Simplify contracting and prioritise local production in public procurement	"*Simplify public contracting processes and create instruments to prioritise local production within public contracting*." (Viseu, farmers' association, man, aged 31-55)
(5) Land, water and territorial planning	Recommendations	Water capture requirements in the built environment	"*Mandatory installation of a water capture system in all new buildings*." (Tavira, health care, woman, aged 31-55)
		Regionalization at municipal level	*"This ties in with one of our proposals, which is regionalisation. There should be multidisciplinary food projects to guarantee the right to food (…) at the municipal level."* (Lisbon, public administration, woman, aged 31-55)
		Land access as a foundation	*"Promote access to land (…) if people don't have land, all of this collapses*." (Viseu, farmers' association, man, aged 31-55)
	Instruments	Require a dedicated water-harvesting plan in new buildings (simple cistern and connection system)	*"New buildings should be required to include a dedicated technical design for rainwater capture. It's just a cistern, a connection system. Something very simple*." (Tavira, farmers' association, man, aged 31-55)
		Strengthen the land cadastre to enable land consolidation and address minifundia.	*"The problem of land consolidation and minifundia is related to the lack of a land cadastre. We don't know who owns that land. There are now some programmes, and it has been tried in different ways."* (Lisbon, public administration, woman, aged 31-55)
		Local multi-actor councils backed by municipalities	"*It is essential that municipalities take a clear stance on establishing or strengthening these spaces, whether called councils or something else, these multi-actor and multi-sector spaces where these issues necessarily have to be debated.*" (Viseu, civil society, woman, aged 31-55)
(6) Economic viability and rural development	Recommendations	Support and include territorial actors in strategy design	"*Support and identify territorial actors and include them in defining local strategies*." (Tavira, producer, woman, aged 31-55)
		National label and broader social engagement	"*A national producer label (…) will move the economy (…) and should involve society: schools and television*." (Lisbon, civil society, man, aged 56-70)
		Viability as a condition for adoption:	"*If farmers do not have a financial return at the end of the month, they will not do it."* (Viseu, producer, woman, aged 31-55)

Instruments	Continuity support for territorial impact projects:	"*Create support for territorial impact projects (…) with recognition and continuity, so they are not dependent on ad hoc applications.*" (Tavira, producer, woman, aged 31-55)
	Adjust procurement scoring rules dominated by cost:	"*In public procurement (…) 99% of who wins the tender is cost, we need to change the scoring.*" (Lisbon, processing sector; man, aged 31-55)
	Target instruments to sustainable family farming and recognition:	"*Policy instruments directed specifically to sustainable family farming, valorisation and recognition of family farming.*" (Viseu, civil society, woman, aged 31-55)

Table 3 | Illustrative excerpts by theme, question type, and coding label (Q2–Q3). Excerpts are translated from Portuguese and reflect small-group syntheses reported in plenary; actor profile and age group refer to the participant who presented the table's synthesis.

To provide a cross-territorial overview, Fig. 5 summarises the distribution of coded items across the six themes for recommendations (Q2) and instruments (Q3) in each territory. Items were aggregated by theme, question and territory based on the thematic coding process described above. For recommendations (Q2), distributions show cross-territorial overlap alongside some territorial variation. Patterns for instruments (Q3) were more differentiated, with greater emphasis on markets and public procurement in Tavira, land and territorial planning in Lisbon, and economic viability and rural development in Viseu.

	TAVIRA		LISBON		VISEU	
	Recommendations	Instruments	Recommendations	Instruments	Recommendations	Instruments
Health, right to food and healthy diets	0	0	10	8	2	0
Education, food literacy and intergenerational learning	12	4	13	34	36	15
Knowledge, research, training and technical support	1	1	2	8	40	18
Markets, public procurement and short supply chains	0	22	9	35	7	5
Land, water and territorial planning	13	14	2	45	20	12
Economic viability and rural development	9	13	10	16	47	27

Figure 5 | Heatmap of coded content by theme and territory (Questions 2–3). Cells show the number of coded items per theme, disaggregated by territory (Tavira, Lisbon, Viseu) and question type (Recommendations = Q2; Instruments = Q3); colour intensity indicates higher counts. Values represent coded items (not participants, quotations, or votes) and are used as descriptive indicators of cross-territorial emphasis.

3.3. Voting priorities for advancing an agroecological transition

The voting exercise provides an additional descriptive indication of the items participants considered most important at the end of each session. Voting did not aim to establish consensus, but to record individual prioritisation after the group discussion. Across

territories, priorities differed: Tavira concentrated votes on support networks and water-related measures; Lisbon on fiscal measures, policy coordination and education initiatives; and Viseu on demonstration infrastructures, multi-actor food councils, market outlets and land governance. Overall, voting patterns highlighted both recurring concerns across territories and distinct territorial emphases.

In **Tavira**, two items received the highest support (2 votes each): an instrument related to support networks (vi) and a single voted "water package" (v) combining a requirement for rainwater capture in new buildings (R) with an implementation instrument linked to new-building certification (I). Remaining votes were distributed across education, knowledge/training, public procurement and economic-support measures.

In **Lisbon**, voting concentrated in thematic area (vi). The top priority was IRS/tax benefits for consumer purchases of agroecological products (I, 3 votes), followed by three 2-vote items: revising the National Programme for Sustainable Food to incorporate agroecological principles (R), adopting an explicit agroecological policy (R), and introducing State Budget provisions via public-procurement scoring criteria (I). Education also featured through recommendations for agroecology across school curricula. Additional votes addressed intergenerational education and municipal food projects linked to the right to food.

In **Viseu**, the top priorities (2 votes each) were an experimentation/demonstration recommendation linked to agrarian education institutions (iii) and an instrument to create local multi-sector, multi-actor food councils (vi). Remaining votes addressed governance measures, market outlets for short supply chains and healthy meals, and land-governance issues related to land access and tenure processes.

Appendix Table A1 provides a consolidated overview of the prioritised recommendations and implementation instruments discussed across the three focus groups, organised by thematic area, territorial occurrence and voting outcomes.

IV. Discussion

This study examined how food-system actors in three Portuguese territories (Tavira, Lisbon and Viseu) framed agroecological transition priorities and proposed recommendations and implementation instruments through a shared co-design

sequence. Across territories, participants consistently approached agroecological transition as a whole food-system process linking biophysical conditions, knowledge and learning infrastructures, governance and market structures, and exchange and support mechanisms, rather than as a farm-level technical adjustment alone. At the same time, priorities and proposed instruments varied according to local conditions and perceived implementation constraints. Rather than identifying a single transition pathway, the findings point to territorially differentiated combinations of enabling infrastructures, governance arrangements and market mechanisms. This aligns with scholarship treating agroecology as simultaneously practical, knowledge-intensive and political, with transition pathways shaped through institutional and territorial processes rather than through uniform technical models (Rivera-Ferre, 2018; Anderson *et al*., 2019; Rosset & Altieri, 2021).

4.1. Education, knowledge exchange and governance

Across territories, participants repeatedly identified education, knowledge exchange and governance coordination as enabling conditions for agroecological transition. Priorities and proposed instruments converged around curricular integration, practical and intergenerational learning, vocational training, advisory and demonstration infrastructures, local support networks, and multi-actor coordination arrangements. These findings reinforce perspectives treating agroecological transition not simply as technical change, but as a process dependent on institutional, relational and territorial infrastructures supporting collective learning and coordination. Existing literature has highlighted the importance of knowledge and learning systems in agroecological transitions (Wezel *et al*., 2018), as well as the role of actor networks and territorially embedded governance arrangements in enabling transition pathways (Anderson *et al*., 2019). Comparative analyses of agroecology-related policies in Europe similarly identify governance coordination and multi-actor coordination structures as key enabling conditions for implementation (Gava *et al*., 2022, 2025). Niederle *et al*. (2022) further show how participatory governance spaces, extension systems and territorial multi-actor networks can strengthen — or, when dismantled, weaken — the relational capacities necessary for sustaining agroecological transitions.

Education was framed less as generic awareness-raising than as a mechanism for reconnecting scientific, technical and experiential forms of knowledge across generations, institutions and food-system actors. Participants associated agroecological transition with practical learning, long-term institutional support and territorially embedded knowledge exchange, consistent with approaches framing agroecology as a

locally embedded and relational process rather than a transferable set of prescriptive best practices (Anderson *et al.,* 2019; Rosset & Altieri, 2021). Governance and coordination were similarly framed as practical implementation mechanisms rather than abstract principles, particularly through proposals for local councils, municipal coordination structures, support networks and multi-sector arrangements linking agriculture, education, health and local policy actors. Within this perspective, health and right-to-food issues were framed less as questions of individual behaviour than as matters linked to food systems, land-use governance and public coordination, particularly through municipal food projects, healthy diets and food access, consistent with integrated approaches linking environmental, agricultural and public health governance, including One Health perspective (Rulli *et al*., 2025).

The results also suggest that participants differentiated between identifying transition priorities and identifying feasible implementation pathways. While urgency in Question 1 was often associated with broad systemic constraints (e.g., land abandonment, water scarcity, market concentration or disconnection from food systems), Questions 2 and 3 focused more strongly on implementable infrastructures and coordination mechanisms capable of supporting action across sectors and territorial scales.

4.2. Exchange arrangements, public procurement and economic viability

Markets, exchange arrangements and economic viability emerged as central dimensions of transition feasibility across territories. Participants repeatedly linked agroecological transition to the organisation of commercialisation channels, public procurement, institutional catering and local market access, indicating that transition was not understood solely through production practices but also through the conditions shaping circulation, distribution and economic sustainability, consistent with broader food-system approaches to agroecological transition (Anderson *et al.,* 2019).

Across territories, recommendations combined support for proximity markets and short supply chains with proposals for public procurement instruments capable of strengthening local production and organised marketing channels for producers. Voting results reinforced the salience of procurement-related mechanisms, particularly regarding school meals, institutional catering and procurement scoring criteria. These findings are consistent with analyses emphasising that agroecological transitions depend on exchange and institutional arrangements beyond farm-level production, including market-access conditions, intermediation systems and demand-side instruments such

as public procurement and participatory certification (Niederle *et al*., 2022; Ujj *et al*., 2025).

Economic viability was also consistently framed as a condition for adoption. Participants referred to fiscal measures, continuity of funding and institutional backing, procurement rules, recognition mechanisms and support targeting as necessary conditions for enabling transition processes. Rather than appearing as isolated economic concerns, these proposals were closely connected to broader governance and market arrangements shaping the practical feasibility of agroecological transition.

4.3. Territorial differentiation and place-based transition pathways

The findings highlight the territorial differentiation of transition priorities and proposed instruments across the three case studies. Question 1 identified distinct baseline concerns associated with each territory, including aridity and water constraints in Tavira, soil-related concerns in Lisbon, and land abandonment in Viseu. Questions 2 and 3 then combined cross-cutting priorities — particularly education, governance and market organisation — with territory-specific instruments and implementation mechanisms.

In Tavira, proposals focused more strongly on water-related measures, rainfed systems and procurement instruments linked to school meals and local production. Lisbon placed greater emphasis on fiscal measures, procurement criteria, policy alignment and municipal food strategies, while Viseu prioritised advisory and demonstration infrastructures, local multi-actor governance arrangements, land access and support for family farming. These combinations suggest that territorial specificity emerged not as a simple translation from “urgent problem” to “single solution”, but through the assembly of feasible policy packages adapted to different environmental, cultural, institutional and socio-economic conditions.

This reinforces approaches treating agroecological transitions as context-dependent processes requiring place-based combinations of instruments and infrastructures rather than uniform policy templates (Anderson *et al*., 2019; López-García, 2020; López-García & González de Molina, 2021). The findings therefore support a place-based understanding of transition policy in which shared enabling infrastructures coexist with differentiated territorial implementation pathways.

4.4. Policy learning and implementation capacity

Repeated references to piloting, monitoring, evaluation and experimentation infrastructures suggest that participants viewed agroecological transition not only as a question of defining policy objectives, but also of developing implementation capacities capable of supporting adaptation under diverse territorial conditions. Across territories, participants emphasised demonstration initiatives, advisory support, municipal coordination, experimentation spaces and scaling mechanisms as practical conditions for operationalising transition processes. These findings indicate a recurrent concern with how agroecological transition measures can be translated into durable and context-sensitive forms of implementation.

This emphasis on implementation capacity is particularly relevant within the current EU policy context, where the 2023–2027 CAP reform combines increased environmental ambition with flexible and territorially differentiated implementation arrangements (Barral & Detang-Dessendre, 2023). Rather than pointing primarily to a lack of awareness or technical knowledge, participants frequently identified coordination gaps, fragmented support structures and limited operational capacity as barriers to transition implementation. This interpretation is consistent with evidence showing that agroecological transitions are often constrained by institutional fragmentation, uneven advisory systems and weak coordination across governance levels (Ujj et al., 2025).

The findings therefore reinforce the importance of policy-learning and governance infrastructures capable of supporting experimentation, adaptation and coordination across sectors and territorial contexts. More broadly, the results suggest that agroecological transition policies are more likely to become operational when implemented through reinforcing combinations of learning, governance and exchange mechanisms adapted to local implementation conditions, rather than through uniform transition models or isolated technical measures.

V. Conclusion

Using a shared co-design sequence in Tavira, Lisbon and Viseu, this study examined how food-system actors identified priorities, recommendations and implementation instruments for agroecological transition across contrasting territorial contexts. Participants consistently framed transition as a systemic process linking biophysical conditions, learning and knowledge infrastructures, governance and market arrangements, and exchange and support mechanisms, rather than as a farm-level

technical adjustment alone. At the same time, proposed priorities and instruments varied according to territorial conditions and perceived implementation constraints.

Education and knowledge systems, governance coordination, public procurement and market organisation emerged as recurring enabling conditions for transition across the three focus groups. However, agroecological transition was not framed through a single policy model or pathway. Instead, participants combined shared transition priorities with territorially differentiated implementation arrangements reflecting differences in environmental conditions, institutional settings, market structures and local governance capacities. The findings therefore support a place-based understanding of agroecological transition in which implementation depends on territorially adapted combinations of governance, learning and market-support mechanisms.

The study contributes a participatory and territorially grounded analysis of how food-system actors distinguish between transition priorities, strategic recommendations and operational implementation instruments. It also illustrates the potential of structured co-design approaches for eliciting and comparing transition priorities across territories while preserving context-specific perspectives and implementation concerns.

Findings remain bounded by the small number of mixed focus groups and the qualitative, non-representative nature of the participant selection strategy. Future research could apply the approach in additional territories and examine how proposed recommendations and instruments are translated, adapted or contested within policy and governance processes across different institutional scales.

Declaration of generative AI and AI-assisted technologies in the manuscript preparation process

During the preparation of this work the authors used ChatGPT (OpenAI) in order to support English-language editing and improve clarity, concision, and consistency of the manuscript text. After using this tool, the authors reviewed and edited the content as needed and take full responsibility for the content of the published article.

Funding

This research was funded by National Funds through the FCT-Foundation for Science and Technology, IC-P, within the scope of the individual doctoral research grant reference UI/BD/153087/2022. https://doi.org/10.54499/UI/BD/153087/2022.

Acknowledgments

The authors thank the Portuguese Foundation for Science and Technology (FCT) for the financial support to the Research Centre for Natural Resources, Environment and Society — CERNAS (UIDB/00681) and GreenUPorto, funded by national funds via FCT (Foundation for Science and Technology) through the Strategic Projects UIDB/05748/2025 and UIDP/05748/2025, (https://doi.org/10.54499/UID/05748/2025; https://doi.org/10.54499/UID/PRR/05748/2025).

References

Anderson, C. R., Bruil, J., Chappell, M. J., Kiss, C., & Pimbert, M. P. (2019). *Agroecology now!: Transformations towards more just and sustainable food systems*. Palgrave Macmillan. https://doi.org/10.1007/978-3-030-61315-0

Arroteia, J. C. (2023). *A população na geografia de Portugal* (Coleção Geografia e Geógrafos). Associação Portuguesa de Geógrafos. ISBN 978-989-99244-7-5

Barral, S., & Detang-Dessendre, C. (2023). Reforming the Common Agricultural Policy (2023–2027): Multidisciplinary views. *Review of Agricultural, Food and Environmental Studies, 104*, 47–50. https://doi.org/10.1007/s41130-023-00191-9

Calvário, R., & Castro, I. (2022). A questão alimentar em Portugal: (Des)encontros entre políticas públicas, alternativas alimentares cidadãs e a agricultura familiar. *Análise Social, 57*(3), 570–593. https://doi.org/10.31447/as00032573.2022244.06

Cartagena, L. B., Hegger, D., Tittonell, P., & Runhaar, H. (2025). How transformative is agroecological knowledge co-creation? Insights from a systematic literature review. *Agroecology and Sustainable Food Systems, 49*(1), 124–150. https://doi.org/10.1080/21683565.2024.2405885

Chiarella, C., Lamoureaux, Y., Pires, A. A. F., Surls, R., Bennaton, R., Van Soelen Kim, J., Grady, S., Ramos, T. M., Koundinya, V., & DiCaprio, E. (2023). A preliminary assessment of food policy obstacles in California's produce recovery networks. *Agriculture and Human Values, 40*, 1239–1258. https://doi.org/10.1007/s10460-022-10407-1

Costa-Pereira, I., Aguiar, A. A. R. M., Delgado, F., & Costa, C. A. (2025). Recognizing diversity to enable an agroecological transition: Understanding the potential of family farmers in Portugal. *Frontiers in Sustainable Food Systems, 9*, Article 1604961. https://doi.org/10.3389/fsufs.2025.1604961

Costa-Pereira, I., Costa, C. A., & Delgado, C. *Agroecology in public policies in Mediterranean Europe: a comparative study to inform the Portuguese context*. Submitted (not yet published).

Delgado, C. (2023). The role of land as the central piece to sustainable food systems: Lessons learned from Portugal's national food-related policies. *Geography and Sustainability, 4*(1), 84–90. https://doi.org/10.1016/j.geosus.2023.01.001

Feo, O. (2022). *Evaluation of the implementation of the EIP-AGRI: Multi-actor and participatory approaches in European agricultural innovation projects* (Tese de doutoramento, Ghent University). https://biblio.ugent.be/publication/8771055

Gallardo-López, F., Hernández-Chontal, M. A., Cisneros-Saguilán, P., & Linares-Gabriel, A. (2018). Development of the concept of agroecology in Europe: A review. *Sustainability, 10*(4), Article 1210. https://doi.org/10.3390/su10041210

Gascuel-Odoux, C., Lescourret, F., Dedieu, B., Detang-Dessendre, C., Faverdin, F., Hazard, L., Litrico-Chiarelli, I., Petit, S., Roques, L., Reboud, X., Tixier-Boichard, M., de Vries, H., & Caquet, T. (2022). The Common Agricultural Policy and agroecological transition: Between incremental change and systemic transformation. *Agronomy for Sustainable Development, 42*, Article 53. https://doi.org/10.1007/s13593-022-00786-4

Gava, O., Povellato, A., Galioto, F., Prazan, J., Schwarz, G., Quero, A. L., Iragui, U. Y., Massa, C. A., Zilans, A., & Carolus, J. (2022). Policy instruments to support agroecological transitions in Europe. *EuroChoices, 21*(3), 13–20. https://doi.org/10.1111/1746-692X.12367

Gava, O., Vanni, F., Schwarz, G., Guisepelli, E., Vincent, A., Prazan, J., Rainer-Weisshaidinger, R., Frick, R., Hrabalová, A., Carolus, J., Iragui, U. Y., Pyysiäinen, J., Smyrniotopoulou, A., Vlahos, G., Balázs, K., Szilágyi, A. J., Jegelevičius, G., Mikšytė, E., Zilans, A., Frățilă, M., Röös, E., Miller, M., & Povellato, A. (2025). Governance networks for agroecology transitions in rural Europe. *Journal of Rural Studies, 114*, Article 103482. https://doi.org/10.1016/j.jrurstud.2024.103482

Giraldo, O., & Rosset, P. (2018). Agroecology as a territory in dispute: Between institutionality and social movements. *Journal of Peasant Studies, 45*(3), 545–564. https://doi.org/10.1080/03066150.2017.1353496

Gliessman, G. (2016). Transforming food systems with agroecology. *Agroecology and Sustainable Food Systems, 40*(3), 187–189. https://doi.org/10.1080/21683565.2015.1130765

Hepping, S., Breeman, G., & Vijver, M. G. (2025). A CAP on ambitions: Power, fragmentation, and the struggle for transformative policy in the post-2022 Common Agricultural Policy debates. *NJAS: Impact in Agricultural and Life Sciences, 97*(1), Article 2521262. https://doi.org/10.1080/27685241.2025.2521262

Iocola, I., Ciaccia, C., Colombo, L., Grar, B., Maurino, S., Wezel, A., & Canali, S. (2023). Agroecology research in Europe funded by European and transnational programmes:

Current status and perspectives. *Open Research Europe, 2*, Article 139. https://doi.org/10.12688/openreseurope.15264.2

Krueger, R. A., & Casey, M. A. (2015). *Focus groups: A practical guide for applied research* (5th ed.). SAGE Publications.

Lang, D. J., Wiek, A., Bergmann, M., Stauffacher, M., Martens, P., Moll, P., Swilling, M., & Thomas, C. J. (2012). Transdisciplinary research in sustainability science: Practice, principles, and challenges. *Sustainability Science, 7*(Suppl. 1), 25–43. https://doi.org/10.1007/s11625-011-0149-x

Langlais, A. (2023). The new Common Agricultural Policy: Reflecting an agroecological transition—The legal perspective. *Review of Agricultural, Food and Environmental Studies, 104*, 51–66. https://doi.org/10.1007/s41130-022-00183-1

Linares Quero, A., Iragui Yoldi, U., Gava, O., Schwarz, G., Povellato, A., & Astrain, C. (2022). Assessment of the Common Agricultural Policy 2014–2020 in supporting agroecological transitions: A comparative study of 15 cases across Europe. *Sustainability, 14*, Article 9261. https://doi.org/10.3390/su14159261

López-García, D. (2020). Who is the subject of agroecological transitions? Local agroecological dynamisation and the plural subject of food systems transformation. *Journal of Sustainable Organic Agriculture Systems, 70*(2), 36–42. https://doi.org/10.3220/LBF1606213050000

López-García, D., & González de Molina, M. (2021). An operational approach to agroecology-based local agri-food systems. *Sustainability, 13*(15), Article 8443. https://doi.org/10.3390/su13158443

Magalhães, T., Andion, C., & Manoel, A. (2022). Collaborative research, public inquiry, and democratic experimentalism: Contributions and how to apply pragmatism to social innovation studies. *Canadian Journal of Nonprofit and Social Economy Research, 13*(S1), 71–91. https://doi.org/10.29173/cjnser543

Manzano, A. (2022). Conducting focus groups in realist evaluation. *Evaluation, 28*(4), 406–425. https://doi.org/10.1177/13563890221124637

Morgan, D. L. (2013). *Focus groups as qualitative research*. SAGE Publications. https://doi.org/10.4135/9781412984287

Niederle, P., Petersen, P., Coudel, E., Grisa, C., Schmitt, C., Sabourin, E., Schneider, S., Brandenburg, A., & Lamine, C. (2022). Ruptures in agroecological transitions: Institutional change and policy dismantling in Brazil. *Journal of Peasant Studies, 49*(5), 931–953. https://doi.org/10.1080/03066150.2022.2055468

Parsons, K., Hawkes, C., & Wells, R. (2019). *Brief 2: What is the food system? A food policy perspective*. Centre for Food Policy, City, University of London. https://www.citystgeorges.ac.uk/__data/assets/pdf_file/0004/570442/7643_Brief-2_What-is-the-food system-A-food-policy-perspective_WEB_SP.pdf

Rivera-Ferre, M. G. (2018). The resignification process of agroecology: Competing narratives from governments, civil society, and intergovernmental organizations. *Agroecology and Sustainable Food Systems, 42*(6), 666–685. https://doi.org/10.1080/21683565.2018.1437498

Rosset, P. M., & Altieri, M. A. (2021). *Agroecology: Science and politics*. Practical Action Publishing. https://doi.org/10.3362/9781780449944

Rulli, M. C., D'Odorico, P., Galli, N., John, R. S., Muylaert, R. L., Santini, M., & Hayman, D. T. S. (2025). Land use change and infectious disease emergence. *Reviews of Geophysics*, 63, https://doi.org/10.1029/2022RG000785

Saldaña, J. (2013). *The coding manual for qualitative researchers* (2nd ed.). SAGE Publications.

Ujj, A., Nagyné Pércsi, K., Ramos-Díaz, F., Budimir-Marjanović, J., Horstink, L., Queiroga-Bento, R., Mukosha, C. E., Moudrý, J., Diána, K. G., & Jancsovszka, P. (2025). Agroecological adoption pathways in Europe: Drivers, barriers, and policy implication opportunities in the Czech Republic, Hungary, and Portugal. *Agriculture, 15*(23), Article 2414. https://doi.org/10.3390/agriculture15232414

Viegas, M., Wolf, J., & Cordovil, F. (2023). Assessment of inequality in the Common Agricultural Policy in Portugal. *Agricultural and Food Economics, 11*, Article 13. https://doi.org/10.1186/s40100-023-00255-w

Viegas, M., Grilo, C., Pires, S., & Cordovil, F. (2024). Democratizar a Política Agrícola Comum em Portugal: O caso da Coligação Cívica Participar no PEPAC. Análise Social, 60(2), Article e30832. https://doi.org/10.31447/30832

Wezel, A., Goette, J., Lagneaux, E., Passuello, G., Reisman, E., Rodier, C., & Turpin, G. (2018). Agroecology in Europe: Research, education, collective action networks, and alternative food systems. Sustainability, 10(4), Article 1214. https://doi.org/10.3390/su10041214

Table A1. Consolidated voting priorities and implementation instruments across territories.

Notes: Items were consolidated thematically across the three focus groups (Tavira, Lisbon and Viseu). “Type” distinguishes recommendations (R) from implementation instruments (I). “Priority level” reflects analytical consolidation of higher-priority and additional proposals emerging from the voting exercise. Vote totals refer to the number of individual votes allocated during the final prioritisation stage (total votes cast = 37).

Thematic area	Priority	Priority level	Number of votes	Type		Location		
				Recommendation	Instrument	Tavira	Lisbon	Viseu
(i) Health, right to food, and healthy diets	Establish multidisciplinary food projects to guarantee the right to food (municipal → CCDRs/food basins/territorial planning)	1	1		I		L	
	Add sustainability criteria in food purchasing (require local-production integration and document the share/%) to support viability	2		R	I	T		
	Frame food as a right (“food social security”) and promote preventive health/lifestyle change	2		R			L	
(ii) Education, food literacy and intergenerational learning	Strengthen agri-food education through curricular integration of agroecology (basic → secondary → higher education), linked to health.	1 2	3	R			L	V
	Strengthen intergenerational and lifelong learning through public education and multi-actor programmes.	1 2	1	R	I	T	L	V
	Educate through good examples	1	1	R		T		
	Make agroecology mandatory in schools (practical component)	1	1	R		T		
	Develop a strategic education plan (pre-school → secondary) that combines theory and practice and expands outdoor learning from pre-school to build ties to land.	2		R	I	T		
	Strengthen school literacy through transversal educational contributions	2		R	I		L	
	Integrate multiple instruments (farmer incentives + youth training + certification)	2			I	T		
(iii) Knowledge, research, training and technical support	Strengthen education, training and demonstration infrastructures for agroecological transition.	1	4	R	I	T		V
	Produce evidence on the costs and benefits of agroecological transition across ministerial/state budgets	2		R			L	
	Strengthen technical support and participatory knowledge infrastructures for transition	2		R	I			V
(iv) Markets, public procurement and short supply chains	Use public procurement to prioritise local production and strengthen short supply chains (school meals ≈60% via producer cooperatives), improve market outlets/profitability and access to healthy meals, simplify contracting procedures, and use school supply contracts to combat food waste.	1 2	2	R	I	T	L	V
	Strengthen local outlets and short supply chains for agroecological/organic products by creating a seasonal strategic hub for local/regional organic products (reduce footprint; strengthen short circuits), introducing incentives for producers to integrate local markets, revitalising proximity markets through national promotion, and promoting marketing channels.	2		R	I	T	L	V
(v) Land, water and territorial planning	Require water-harvesting and certification standards in new buildings.	1	2	R	I	T		
	Improve land access by promoting access to land and streamlining land-tenure/possession processes for agroecological production	1	2	R	I			V
	Use fiscal instruments to improve land access for agroecological production (rural-land taxes/land bank and fiscal incentives for transition compliance and new producers).	2			I		L	V
	Strengthen support for rainfed/autochthonous dryland species	2		R		T		
(vi) Economic viability and rural development (incl. cross-cutting governance items)	Use fiscal, budgetary and prioritisation tools to support adoption	1	6	R	I		L	V
	Consolidate national policy frameworks and strategies for transition	1	5	R			L	V
	Strengthen governance and territorial coordination through networks and multi-actor arrangements	1 2	5	R	I	T		V
	Reorient agricultural support and incentives to enable adoption and viability	1	4	R	I	T		V
	Develop valorisation and recognition instruments for producers, agrobiodiversity and biocultural memory	2		R	I		L	V
	Link agroecological production with tourism-related demand and policy	2		R	I		L	V
	Total number of votes, recommendations and instuments		**37**	**22**	**18**			

Section III
Overall discussion

This overall discussion synthesises the findings across the four articles to address the guiding research question: Which policy framings and policy levers, when tailored to farm typologies and territorial contexts, are identified as most relevant and feasible to enable agroecological transition in Portugal, using family farms as a strategic entry point? Throughout this section, “relevance” refers to the alignment of policy options with the constraints and priorities identified across farm profiles and territories, while “feasibility” is understood as the combined condition of administrative implementability, actor acceptability, and territorial workability under existing institutional constraints.

Building on this lens, the discussion connects farm-level agroecological performance and enabling conditions (Article 1) with differentiated farmer trajectories and typologies (Article 2), and then interprets these results in relation to how public policies frame agroecology and which levers they privilege or neglect (Article 3). It then draws on the participatory, policy-oriented co-design process (Article 4) to prioritise context-specific policy options that are both relevant to differentiated needs and workable within current governance and value-chain conditions.

Taken together, the thesis suggests four interrelated directions for policy support that are more likely to be relevant and feasible in Portugal: (i) evaluation frameworks that make agroecological performance and enabling conditions legible (including governance and knowledge dynamics); (ii) differentiated support pathways aligned with distinct farm trajectories; (iii) stronger institutional anchoring and coordination capacity; and (iv) territorially grounded policy packages—particularly knowledge infrastructures, multi-actor governance spaces, and demand-side levers paired with collective supply organisation and logistical/administrative support—so that transition becomes workable beyond the farm level and across diverse farm profiles.

A first requirement for “feasible” policy support is therefore visibility: if change processes are not rendered legible, they are unlikely to become eligible priorities for public action. Article 1 provides the first building block of this pathway by showing how evaluation shapes what policy can “see”. By adapting and applying two widely used farm-level assessment tools to Portuguese family farming (FAO’s TAPE and Biovision’s ACT), the study shows that what becomes “visible” as agroecological change is partly shaped by the assessment tool itself. While the results of the two tools converge on some elements (e.g., “Culture and food traditions” scoring high), they can lead to different diagnoses of relative weaknesses, notably shifting attention between knowledge co-creation/sharing and governance-related dimensions (for example, through differences in how “Responsible governance” and knowledge-sharing are captured and synthesised

across elements/themes). More fundamentally, Article 1 demonstrates that assessment design—including how criteria and indicators are organised and synthesised into element/theme outputs—can alter performance values and therefore move the priorities that appear policy-relevant. The study also highlights the need to adapt question sets to Portuguese/European realities and notes that limited access to organised information (notably on biodiversity and soil health) can constrain what can be assessed in practice. Finally, it stresses that assessment becomes more useful when results are returned and discussed with farmers, enabling ownership of findings and the identification of solutions and collective pathways. For the thesis' guiding question, this means that evaluation is itself a policy lever: it helps public authorities identify which constraints lie within farm management and which require action on enabling conditions (knowledge, coordination, governance) to make transition feasible. Two implications for policy design follow from these findings. First, Article 1 shows that evaluation does not simply document change: it shapes what becomes legible and, in turn, what is likely to be compared and prioritised for support. The farm-level assessment literature reinforces this point by showing that indicator choice and aggregation can steer interpretation towards what is most readily measurable and data-supported, influencing which dimensions appear policy-relevant and practically usable (de Olde *et al*., 2016; Bonisoli *et al*., 2018). Second, the article also indicates that making governance and knowledge co-creation visible is not secondary, because these dimensions condition the feasibility and durability of transition pathways; Wezel *et al*. (2020) similarly identify "Co-creation and Sharing of Knowledge" and "Responsible Governance" as key entry points. In that sense, assessment outputs can be treated as inputs to dialogue and iterative learning rather than as closed results: Moeller *et al*. (2023) explicitly position evaluation frameworks as "conversation starters" with pedagogical value and as tools that evolve through communities of practice and feedback, while Cassart & Frei (2025) show how frameworks can function within reflexive arrangements when they are used in cycles of feedback and member checking and are updated with participants over time.

A second set of findings concerns who transitions, how, and under which conditions. Because "tailoring" requires an empirical understanding of diversity within family farming, the analytical pathway moves from visibility (Article 1) to differentiation (Article 2). Building on Article 1's insight that assessment makes change legible, Article 2 adds that what becomes actionable for policy also depends on who is being assessed and supported: Portuguese family farms are better understood along a continuum of profiles—conventional, proto-agroecological and agroecological—rather than a binary divide, pointing to differentiated trajectories with distinct starting points and capacities to

move over time. Importantly, the proto-agroecological profile can be interpreted as a relevant leverage point for policy, because it combines partial agroecological practices with clear needs for enabling conditions; targeted learning and risk-reducing support can therefore generate momentum by helping farms move further along the continuum. This profile is policy-relevant because targeted support may help address identifiable bottlenecks and support further movement along the transition continuum, given its openness to change and the presence of identifiable bottlenecks that public action can address. The policy implication is that instruments do not land on a homogeneous target group: the same lever can be enabling for some farms and difficult—or indirectly exclusionary—for others unless access conditions and support packages are calibrated to profile-specific resources, constraints and transition strategies. This logic is consistent with work arguing that understanding farm diversity is a precondition for designing differentiated transition strategies that remain workable for contrasting farming realities (Teixeira *et al.,* 2018). At the same time, typology-informed targeting is not automatically legitimate: if differentiation is perceived as opaque or unfair, it can reduce acceptance and participation, making perceived justice and transparency central to feasibility (Huber *et al*., 2024). As one concrete illustration, Article 2 finds that the clearest statistically significant difference between clusters concerns support for regulatory measures to restrict/tax synthetic pesticides, with stronger support among agroecological farmers. A policy design implication is that, if such measures are introduced without accompanying support, they may increase short-term adjustment costs and perceived risk for conventional farms that still rely on synthetic herbicides; transition-enabling packages (e.g., phased incentives and peer learning) can therefore help preserve feasibility and avoid socially selective uptake. Finally, the continuum helps capture partial or "unclaimed" forms of ecological improvement among more conventional profiles—changes that may not be articulated through an agroecology identity and can remain under-recognised in policy narratives (Lucas, 2021). This reinforces that engagement is not only technical but also symbolic, and that recognition-oriented narratives can shape who feels addressed by "transition" policies (López-García *et al*., 2023).

Because feasibility is shaped not only by farm-level capacities but also by how policy defines, funds and governs "transition", the analytical pathway moves from differentiation (Article 2) to institutionalisation (Article 3). Article 3 provides the third building block of the thesis by identifying which policy framings and levers are currently prioritised, and which remain weakly embedded, when agroecology is institutionalised. Based on a combined analysis of policy instruments and expert perspectives across Portugal, Spain and France, it shows that institutional incorporation is partial and uneven

and tends to concentrate on orientations that are easiest to translate into existing instruments. In practice, explicit policy references tend to cluster mainly around Gliessman's Levels 3 and 4 (agroecosystem redesign and producer–consumer reconnection), while Level 5 (system-wide transformation) and participatory, equity/justice-oriented governance remain comparatively marginal (Gliessman, 2016). For the guiding research question, this matters because it locates a core feasibility bottleneck in governance and coordination—not only at farm level. It also links back to Article 1: when institutionalisation privileges instrument-ready framings, uptake can concentrate on what is most readily operationalised, while governance-oriented enabling conditions remain less visible and less consistently supported. This risk of narrowing is consistent with accounts that stress how agroecology is contested and can be resignified through institutional uptake (Rivera-Ferre, 2018; Rosset & Altieri, 2021).

The cross-country comparison is used here only to surface institutional trade-offs that clarify what "feasible institutionalisation" can look like for Portugal. For France, Article 3 suggests that stronger national anchoring and flagship schemes can increase policy visibility. At the same time, Clément *et al*. (2023), analysing the implementation of national participatory schemes (GIEE and "30,000 farms") in Occitanie, report that participation often concentrates among farmers who are already embedded in networks and other programmes, creating "virtuous circles" of access and raising risks of social selectivity. Complementary analyses of territorial food projects also point to relatively top-down dynamics in the introduction of some territorial instruments, shaping how participation and local autonomy unfold in practice (Lamine *et al*., 2023). Regarding Spain, by contrast, Article 3 illustrates the value of regional and municipal experimentation and local networks, while also showing how continuity and scaling can remain fragile in the absence of stable multi-level coordination and long-term institutional support (Article 3). Portugal emerges from Article 3 as a "recognition without consolidation" configuration: agroecology is present in discourse and scattered initiatives but remains weakly embedded in core national policy frameworks, relying disproportionately on education/research and locally anchored projects (Article 3). Read together with Article 2, these patterns underscore that institutional designs can become implicitly selective when governance arrangements and access conditions align mainly with actors that already have higher resources and institutional capacity to participate.

For Portugal, Article 3 translates this diagnosis into four interrelated implications for "relevant and feasible" policy support. First, an explicit legal definition of agroecology can serve as an institutional anchor for coherence and legitimacy—provided it integrates ecological, social and political dimensions and avoids technified narrowing through

institutional resignification (Rivera-Ferre, 2018; Rosset & Altieri, 2021). Second, feasibility is tightly linked to multi-level coordination: stronger alignment between EU, national and regional levels is critical for translating CAP and Green Deal orientations into territorially grounded strategies for soil, water and climate resilience, especially given the reliance on largely voluntary instruments in CAP implementation (Frank & Schanz, 2025). Third, equity and inclusion function as feasibility conditions: reducing administrative frictions and simplifying access rules helps prevent selective participation and uneven uptake, in line with evidence on CAP-related disparities and the importance of simplified access for smaller farmers (Dinis, 2024). Fourth, participation beyond already "virtuous" actors remains a recurrent bottleneck: broader dialogue among farmers, local authorities, researchers and civil society is needed to sustain reconnection dynamics and build durable governance arrangements; this is consistent with arguments that scaling agroecology requires mobilising heterogeneous social majorities through holistic political projects linking production, distribution and consumption (Petersen & González de Molina, 2025).

Article 4 provides the fourth building block by operationalising these institutional implications through territorially grounded co-design. Using a shared co-design sequence with mixed focus groups in Tavira, Lisbon and Viseu, the study shows that transition is negotiated in concrete places, where biophysical constraints, implementation capacity and social relations shape what is workable, for whom, and through which pathways. Rather than producing a universal list of instruments, the process identified shared enabling conditions and territory-specific policy packages assembled in response to local constraints and opportunities. Prioritisation was conducted through facilitated collective ranking, complemented by qualitative synthesis, collective prioritisation and cross-territorial comparison, thereby making explicit how participants assessed both perceived relevance and feasibility in each territory.

Across territories, two cross-cutting priorities recurred: education and learning, spanning curricula, vocational training, experiential learning and peer exchange; and coordination and governance, including mandates and spaces for multi-actor collaboration linking agriculture with health, education, environment and planning, aligning with European work that highlights governance networks, learning and knowledge exchange as key mechanisms for sustaining agroecological transitions (Gava *et al*., 2025). Participants also stressed that feasibility depends on exchange arrangements beyond the farm gate, including who buys, under which conditions, and with what logistical and organisational support. In this respect, demand-side levers for institutional catering, including public procurement, were consistently discussed together with collective supply organisation

and logistical/administrative support as a way to stabilise outlets and reduce economic uncertainty, which also aligns with European policy-instrument mappings that identify procurement among relevant levers for agroecological transitions (Gava *et al*., 2022). Finally, repeated calls for piloting, monitoring and evaluation expressed a pragmatic demand for policy-learning mechanisms, namely testing, adjusting and scaling under real-world constraints, resonating with approaches that emphasise social learning settings and dynamic monitoring and evaluation in agroecological knowledge co-creation (Cartagena *et al*., 2025).

Building on this point, territorial differentiation does not replace social differentiation; it intersects with it. The same place-based package (e.g., learning infrastructures, governance arrangements, procurement and other exchange mechanisms) will be accessed and used differently by farms positioned at different points along the continuum identified in Article 2. The policy design question is therefore not only who benefits, but whether the package reduces—or inadvertently reproduces—the frictions that shape movement along trajectories. In practical terms, this implies calibrating learning and advisory components so they effectively de-risk consolidation steps for proto-agroecological farms, while ensuring that simplified access rules, administrative support and risk-sharing mechanisms reduce the risk that more resource-constrained conventional farms are effectively left out.

Taken together, the evidence from the four articles suggests five implications for policy design. First, Articles 1 and 2 indicate that assessment is not neutral documentation: the choice, ordering and aggregation of criteria and indicators shapes what counts as “agroecological performance” and which constraints and enabling conditions become visible and comparable, so assessment design and reporting need to be treated as a policy-relevant device and adapted to Portuguese/European realities, including known information bottlenecks (e.g., organised data for biodiversity and soil health) and the visibility of governance and knowledge dimensions. Second, Articles 2 and 3 show that policies do not land on a homogeneous target group and that institutional designs can become implicitly selective; this supports treating differentiation and inclusion as design principles by calibrating instruments and support packages to distinct positions along the continuum of farm trajectories, while simplifying access and reducing barriers that tend to disadvantage smaller and less-resourced farms. Third, Article 4 shows that across territories, transition feasibility was repeatedly tied to learning capacities and implementation support (curricula, vocational and experiential learning, advisory/extension, demonstration infrastructures), and to explicit demands for policy-learning mechanisms (pilots with monitoring/evaluation and scaling), implying that

learning should be treated as infrastructure rather than an add-on to incentives. Fourth, Article 3 identifies governance as a recurring bottleneck for deeper transformation and translates this into institutional requirements, notably a clearer institutional anchor (including a legal definition integrating ecological, social and political dimensions) and stronger alignment across EU, national and regional levels so CAP/Green Deal orientations translate into territorially grounded strategies for soil, water and climate resilience; Article 4 complements this by showing that, in practice, territorial workability hinges on cross-sector, multi-actor coordination spaces (networks, councils, municipal food projects) that connect agriculture with domains such as health, education, environment and planning. Fifth, Article 4 indicates that territorially grounded packages must address exchange arrangements beyond production practices, with public procurement and supply organisation for institutional catering repeatedly prioritised as a way to secure stable outlets (often coupled with calls to simplify contracting procedures and build supply capacity), while Article 3 highlights that participation and reconnection dynamics must extend beyond already “virtuous” actors, reinforcing the need for demand-side levers to be embedded in broader, inclusive governance and coordination arrangements.

Figure 1 synthesises this cumulative logic visually, linking the conceptual framework to the research questions and objectives of Articles 1–4 and showing how their empirical contributions converge in the discussion to inform evidence-based orientations for public policy proposals for agroecological transitions in Portugal.

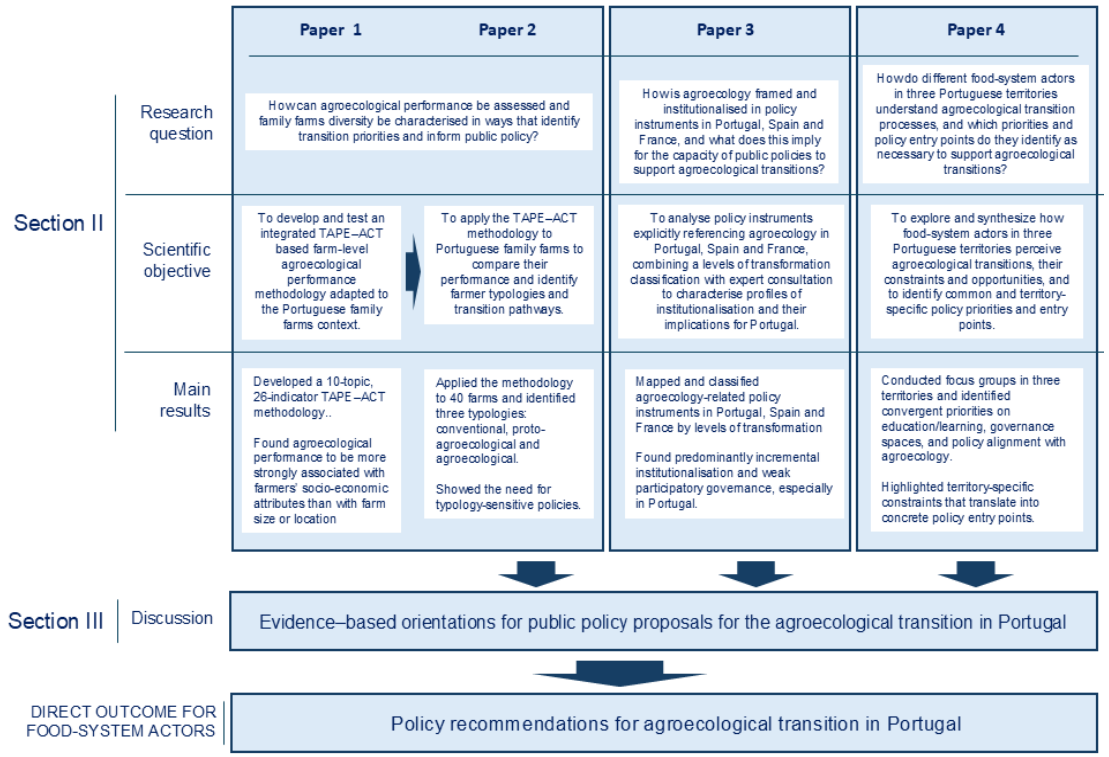


Figure 1 | Analytical pathway of the thesis and cumulative logic across the four papers. The figure connects the conceptual framework (Section I) with the research questions and scientific objectives of Articles 1–4 (Section II) and shows how their empirical contributions are integrated in the discussion (Section III) to inform evidence-based orientations for public policy proposals for agroecological transitions in Portugal.

Cumulative contributions of the thesis:

Methodological: Adapts and combines farm-level assessment approaches (TAPE and ACT) for the Portuguese family-farm context, highlighting the need for contextualisation of indicators and reframing evaluation as a governance and learning infrastructure; it also shows how aggregation choices (including weighting and synthesis into elements/themes) shape interpretation and, in turn, perceived policy priorities.

Empirical/typological: Develops an empirically grounded typology that characterises Portuguese family farms along a continuum of profiles, clarifying heterogeneous transition trajectories and indicating how policy needs may differ across starting points and capacity constraints; this provides an analytic basis for designing differentiated support while avoiding one-size-fits-all targeting.

Institutional/comparative: Analyses agroecology's policy institutionalisation in Portugal, Spain and France, showing how policy uptake tends to cluster around mid-level transition orientations and why governance and coordination persist as recurrent bottlenecks for system-wide transformation.

Territorial/participatory: Demonstrates how multi-actor focus groups and a co-design process translate assessment, typology and policy insights into territorially grounded priorities and feasible policy packages, centred on education/learning and coordination/governance, complemented by demand-side levers (e.g., public procurement) and iterative policy-learning mechanisms (pilots, monitoring and evaluation).

These findings should be interpreted in light of three main limitations. First, the farm-level assessment and typology results (Articles 1–2) are grounded in a limited empirical sample, so they support mechanism-oriented interpretation rather than statistically representative claims about the full heterogeneity of Portuguese family farming. Second, the policy analysis (Article 3) focuses on legislative and para-legislative instruments and on explicit references to agroecology; it therefore captures institutional framings more directly than implementation dynamics, budgeting, uptake, enforcement, or measured impacts, including potentially aligned policies operating under other labels. Third, the territorial co-design (Article 4) draws on focus groups in three territories and may reflect selection effects linked to local networks and participation dynamics; the outputs should be read as feasible, context-specific priorities and mixes rather than a transferable blueprint, and their value ultimately depends on structured territorial feedback and follow-up with the actors who co-produced them.

Future research should extend the empirical and governance reach of this work while strengthening its collective, iterative orientation. Farm-level assessment should be applied to larger and more diverse samples and completed through full cycles that include returning results to territories, collective interpretation, and follow-up, so evaluation can be tested as a governance and learning arrangement in practice. Longitudinal designs are needed to observe movement along the continuum of profiles, identify bottlenecks, and assess which combinations of support accelerate transitions for different farms under different enabling conditions. Documentary policy analysis should be complemented with implementation studies that examine administrative capacity, budgeting, uptake, enforcement, accountability and distributional effects, including policies relevant to agroecological transition that are not labelled as such. Finally, territorial co-design should be replicated in additional contexts and combined with process tracing to examine how prioritised recommendations are refined through dialogue, translated into instruments and decisions, and monitored over time, thereby linking research more directly to territorial governance processes and measurable change.

Conclusion

This thesis argues that enabling agroecological transition in Portugal is a central governance challenge that links differentiated farm trajectories, territorial constraints, and the institutional conditions that make change implementable over time. Agroecological transitions among Portuguese family farms are more likely to be supported by typology-sensitive and territorially grounded public policies when three interlocking conditions are met. First, assessment must be contextualised and used as a governance and learning device. Because assessment design shapes what becomes legible as “agroecological performance” and can bias attention toward what is easiest to quantify, it must keep enabling conditions visible, especially knowledge and governance dynamics, and feed results back into farmer dialogue and iterative learning cycles. Second, policy must recognise family-farm diversity as differentiated trajectories along a continuum, so eligibility rules and support are calibrated to distinct starting points and capacities rather than assuming a single “model farm”. Operationally, this implies differentiated support packages that combine incentives with advisory and learning capacity, simplified access and administrative support, and risk-sharing mechanisms appropriate to each trajectory. Third, transition requires participatory multi-level governance with mandates and coordination capacity to translate CAP and Green Deal orientations into territorial strategies. This requires concrete governance spaces and enabling infrastructures, including advisory and training networks, multi-actor coordination platforms, and demand-side mechanisms. A key example is public procurement paired with supply organisation and logistical and administrative support. Together, these elements help stabilise outlets beyond the farm gate. Across the thesis, transition emerges as a contested, multi-level process rather than the linear diffusion of best practices, with outcomes co-produced by farm strategies and the enabling environments in which they operate.

Answering the guiding research question, the thesis identifies as “relevant and feasible” those levers that simultaneously improve policy legibility, reduce transition frictions across heterogeneous trajectories, and strengthen territorial workability through coordination and exchange conditions. This shifts policy away from isolated practice incentives toward the institutional, knowledge, governance and market arrangements that make agroecological strategies workable, durable and inclusive.

The thesis addresses its scientific objectives through four cumulative contributions, corresponding to SO1–SO4:

SO1 | Adapted and tested a combined farm-level assessment approach (TAPE + ACT) for Portuguese family farming, showing how evaluation design and aggregation choices shape what becomes visible, comparable and actionable for policy and learning.

SO2 | Operationalised family-farm diversity through a continuum of profiles and trajectories, showing how measures interact with farms' positions and enabling conditions and identifying proto-agroecological farms as a strategic leverage point in the empirical material.

SO3 | Compared agroecology policy institutionalisation in Portugal, Spain and France, showing partial uptake concentrated in mid-level transitions and identifying governance, coordination, participation and justice-related gaps as recurrent constraints on deeper transformation.

SO4 | Translated assessment, typology and policy insights into territorially grounded priorities through mixed focus groups, identifying education/learning and coordination/governance as shared enabling conditions and highlighting procurement and other exchange arrangements, alongside policy-learning mechanisms, as critical for feasibility and implementation over time.

Taken together, the thesis contributes an integrated approach to designing and governing agroecological transition policy that treats assessment, typologies and territorial governance as mutually reinforcing. Each domain answers a distinct policy question. Assessment improves what institutions can see. Typologies improve who policies can reach fairly by making differentiated trajectories and access frictions explicit. Territorial governance improves how policy mixes become workable in practice under real constraints. For Portugal, the findings indicate that more effective support would combine territorial multi-actor arenas that assemble and adapt policy mixes to local constraints with a coherent national strategy. This strategy should be anchored in a legal definition of agroecology that integrates ecological, social, and political and governance dimensions, and that supports coherence across instruments. It should also be coupled with stronger coordination across levels and sectors. A central task is therefore to build institutional arrangements that link advisory and training networks, coordination mandates, demand-side instruments such as public procurement with the organisational and logistical conditions needed for institutional catering, and policy-learning mechanisms such as pilots, monitoring and iterative evaluation. This should reduce the risk that participation remains concentrated among already better-resourced actors. It

should also allow policy mixes to be adjusted as constraints and opportunities evolve across territories.

This thesis should not be read as a self-contained endpoint, but as a moment within a longer collective process. The research depended on the time, knowledge and trust of farmers, municipal officers, civil-society organisations, researchers and other actors who engaged in the co-construction of diagnoses and proposals. They are not simply “informants” or “stakeholders”, but co-producers of the knowledge and recommendations presented here. This reflects the thesis’ epistemological stance that transition knowledge is situated and produced through sustained relationships, and that policy-relevant evidence depends on deliberation and reciprocity, including structured restitution and dialogue, rather than one-way extraction of data.

A key next step is the structured return of results to the territories and actors involved. This means organising spaces of dialogue in Tavira, Lisbon, Viseu and other contexts where assessment results, typologies and co-designed recommendations can be discussed, refined and prioritised. One possible format would combine joint interpretation workshops around the evidence produced, validation of typology-sensitive implications for differentiated trajectories, and the co-definition of pilot actions, where relevant, with clear responsibilities, timelines and monitoring indicators. Such feedback processes can support operationalisation, generate new partnerships and provide a setting in which future research directions are pursued in close connection with territorial practice. The set of prioritised recommendations derived from this research, and further specified where convergent with complementary co-produced inputs, is presented below this conclusion, to facilitate its use in these territorial feedback and governance processes.

This orientation is consistent with agroecology understood as a systemic, relational and participatory approach, and with broader commitments to epistemic justice and democratic governance of food systems. In practice, this implies research–policy interfaces that support local governments and civil-society organisations in agroecological food strategies and plans, contribute evidence to national debates on agroecology, its legal and policy recognition, and the right to food, and connect Portuguese agroecological experiences to transnational learning arenas, movements and policy dialogues.

Portuguese family farms, approached here as a strategic entry point into wider food system transformation, emerge not as passive recipients of policy but as active agents in agroecological transitions. Their potential, together with that of other food system actors, can be enhanced by participatory and territorially grounded public policies. By

combining farm-level assessment, typological analysis, policy review and participatory co-design, and by generating prioritised recommendations centred on education, governance and coordination, policy alignment and territorial specificity, this thesis provides both a diagnosis and a set of tools to support that effort. Its central contribution is to show that transition policy is not only a matter of incentivising practices, but of building the institutional, knowledge and exchange conditions that can sustain change. The longer-term relevance of this work will depend on how it is taken up, transformed and expanded by those who continue the process in the fields, institutions and territories where agroecology is being made.

Operational list of policy recommendations for agroecological transition in Portugal

This operational list of policy recommendations is not a stand-alone output of a single method. It was built through triangulation of three evidence streams from the thesis: (i) the differentiated needs and transition frictions identified through the typology and trajectories of Portuguese family farms (Article 2); (ii) the comparative diagnosis of how agroecology is framed and institutionalised in public policy, including recurrent governance and coordination bottlenecks (Article 3); and (iii) the territorially grounded priorities and policy packages co-produced in mixed focus groups (Article 4). The recommendations are intended as a basis for deliberation and adaptation in specific territories, rather than as a ready-made blueprint, and they should be read as a coherent policy "mix" in which definition/anchoring, governance, implementation instruments, and monitoring/learning reinforce one another.

In addition, to strengthen the operationalisation of food system and demand-side levers (e.g., cross-sector governance, food literacy, public procurement and institutional catering), the list integrates selected recommendations from a multi-actor co-construction process on protein transition in Portugal convened by ACSA and ANP|WWF[20] (c. 30 participants across public administration, academia, the private sector and civil society). These inputs are included only where they converge with—and help specify—the levers identified in Articles 3–4, and they are presented as co-produced contributions, not personal additions.

1. Adopt a systemic definition of agroecology in national policy. Agroecology should be defined in law and strategy documents as a food system approach, not as a list of farm "good practices" or a sub-label of organic farming. The definition should align with the FAO Ten Elements, the HLPE Thirteen Principles and the Nyéléni vision (IFA, 2015), explicitly linking ecological processes, social justice, cultural diversity and democratic

[20] https://acsa.ong/wp-content/uploads/2024/10/ACSA_RECOMENDACOES_TRANSICAO_PROTEICA.pdf

governance. This systemic definition can then be used as a common lens to reinterpret agricultural, food, health, social, environmental and territorial policies. To avoid symbolic adoption, the definition should be systematically used as a "coherence test" for policy design and programme revision. Concrete measures may include:

- Using the national definition of agroecology as a reference for a National Strategy for Agroecological Transition and for revising existing programmes on sustainable food and nutrition so that they explicitly integrate the ecological, social and political dimensions of agroecology.
- Considering food provision within broader approaches to "social security of food", linking agroecological transition with social protection instruments.

2. Establish interministerial governance for agroecology and sustainable food systems. Create a dedicated interministerial coordination mechanism (e.g., through a State Secretary, interministerial commission or equivalent structure) for agroecology and sustainable food systems. This structure should include agriculture, health, education, environment, social security, territorial cohesion, economy and tourism, and provide formal participation channels for municipalities, farmers' organisations and civil-society networks. It should coordinate national strategies and ensure coherence with relevant frameworks (e.g., the CAP Strategic Plan, the European Green Deal and Farm to Fork), as well as the Milan Urban Food Policy Pact and related initiatives. CeCAFA (Centre of Competences for Family Farming and Agroecology) should be included. The mechanism should have an explicit mandate for implementation steering (not only consultation), clear resourcing, and minimum standards for inclusive representation beyond already agroecological actors. Concrete measures may include:

- Identifying and supporting key territorial actors (farmers' organisations, cooperatives, consumer groups, NGOs and municipal projects) and formally involving them in the definition of local and regional food strategies, with dedicated funding for high-impact territorial projects.
- Reinforcing farmers' associations and cooperatives as interlocutors in multi-actor councils and interministerial working groups, recognising their role in representing diverse farmer profiles, including small and conventional family farms.
- Ensuring that the interministerial mechanism explicitly integrates the right to food in its mandate and connects agroecology with social policies on food security and social protection.

3. Develop a national programme for food literacy and education on food systems. A national programme on food literacy and food system education should be created, connecting schools, health services, social services, municipalities and civil-society organisations. This programme should place agroecology at the centre of learning processes, linking food and agriculture with climate, biodiversity, health and social justice. It should build on and strengthen existing Portuguese programmes on healthy eating, ensuring that they incorporate agroecological principles and territorial perspectives rather than focusing only on nutritional guidelines. This is consistent with One Health perspectives and with current Portuguese programmes on healthy eating (e.g., National Plan for Healthy and Sustainable Food—PNAES; National Programme for the Promotion of Healthy Eating—PNPAS). The programme should prioritise practice-based learning and long-term territorial connections (rather than one-off awareness campaigns), reflecting reported gaps in formal and informal agroecology education. Concrete measures may include:

- Developing a national strategic plan for environmental and food education from pre-school to secondary level, combining theory and practice and creating long-term connections with land, food and agroecosystems.
- Supporting school projects and courses on agriculture and agroecology with a strong practical and outdoor component from early childhood education onwards (school gardens, farm visits, field projects).
- Including agri-food and agroecology topics explicitly in secondary school curricula (e.g., biology and geology), and ensuring transversal contributions in other subjects where relevant.
- Creating intergenerational programmes and councils that bring together schools, social-solidarity institutions and associations around agroecology-related activities, reinforcing intergenerational learning and care.
- Integrating food, diet and agroecology into health promotion and preventive medicine, supporting changes in lifestyles and emphasising healthy, sustainable diets as a first line of care in primary health services.

4. Use public catering and procurement as levers for agroecological transition. Treat public food provision (schools, universities, hospitals, social services, public canteens) as a strategic lever to support agroecological and territorial food systems. Public procurement rules should move beyond lowest-price criteria and incorporate social, environmental and territorial criteria that favour local, seasonal and agroecological products, while guaranteeing nutritional quality and affordability. To enable smaller and diversified farms to participate, procurement reform should be paired

with supply organisation and aggregation mechanisms (e.g., cooperatives and territorial hubs). This pairing is critical to prevent procurement from becoming selectively accessible only to larger or already organised suppliers. Concrete measures may include:

- Simplifying public procurement procedures and creating clear instruments to prioritise local and agroecological production in tenders for school canteens, hospitals and other public institutions.
- Introducing contracts with schools and social institutions that combine supply agreements with food-waste reduction targets, linking agroecological procurement to circular-economy objectives.
- Adding explicit sustainability factors in public food purchasing, including progressive targets for the share of local, seasonal and agroecological products, and regularly documenting and publishing the percentage achieved.
- Developing guidance and capacity-building for municipal and regional procurement teams so they can apply social and environmental criteria and work effectively with smaller producers and cooperatives.

5. Reorient agricultural and rural development incentives towards agroecological systems. Adjust agricultural and rural-development supports so that they: (i) reduce incentives for high-input, high-impact systems (e.g., intensive livestock and monocultures); (ii) increase payments for diversified, low-input systems that provide ecosystem services (soil fertility, biodiversity, water regulation, climate adaptation); and (iii) support conversion and technical assistance for farms moving towards agroecology. This can be implemented mainly through the PEPAC, agri-environment-climate measures, the National Strategy for Organic Agriculture (ENAB) and the Family Farming Statute, using criteria that reward combinations of agroecological practices rather than single measures. Supports should be explicitly typology-sensitive (e.g., conventional, proto-agroecological and agroecological configurations), recognising different transition starting points and risks of exclusion. Concrete measures may include:

- Introducing targeted incentives for agroecological products, including support for the creation and strengthening of circuits and channels for marketing agroecological products (short supply chains: local shops, weekly markets).
- Creating incentives for producers to integrate local markets and farmers' markets, including support for market infrastructure, logistics and collective marketing initiatives.

- Developing a national label or award scheme for territorial agroecological products, linked to transparent criteria and used in communication and tourism promotion.
- Supporting local and seasonal hubs for agroecological products (including in tourist destinations) and encouraging Turismo de Portugal and other public entities to source from these producers in national and international events.
- Strengthening instruments to valorise native breeds and local varieties, particularly drought-resistant and low-input systems, and linking these to agroecological incentives and biodiversity strategies.
- Encouraging integrated policy packages that combine financial incentives for farmers, training for young people and transparent recognition schemes for local and seasonal products based on agroecological principles.
- Providing technical support and extension services oriented to agroecological transition, including on-farm advice, farmer-to-farmer exchanges and the use of demonstration farms; administrative simplification and application support should be treated as core design features to reduce barriers for small and diversified farms.

6. Integrate agroecology into land, water and territorial policies. Land and water policies should explicitly recognise agroecological farming as a strategic use that contributes to climate adaptation, biodiversity, soil conservation and fire-risk reduction. Territorial instruments should protect agricultural soils, facilitate access to land for agroecological family farming and promote land-use mosaics that reduce vulnerability to droughts and wildfires. This implies: (i) effective protection of soils with agricultural aptitude in municipal and regional spatial plans, including the use of “food basin” concepts; (ii) simplified, transparent mechanisms for access to land (land banks, management of abandoned and ownerless plots), with safeguards for local rights; (iii) alignment of water policies with support to diversified rainfed systems and crops adapted to increasing aridity, especially in Mediterranean regions under high stress. These directions are consistent with the thesis’ framing of Mediterranean contexts as facing intensifying drought and water-scarcity pressures, interacting with land-use change and territorial vulnerability, which strengthens the case for place-based land–water–food strategies. Where relevant, implementation should include practical enabling measures such as cadastral clarification and tenure streamlining to reduce transaction costs for land access. Concrete measures may include:

- Strengthening support for agriculture based on autochthonous, drought-resistant species and varieties, especially in Mediterranean dryland systems, as a lever for climate adaptation and biodiversity conservation.
- Creating fiscal incentives and land-access instruments (e.g., land banks, reduced taxes or fees) for farmers who start production or manage land under defined agroecological transition criteria.
- Recognising and supporting initiatives that safeguard biocultural memory of territories—such as traditional practices, seeds and landscape management—and integrating these into territorial development and landscape policies.

7. Build territorial food system governance. Local and regional governance structures should be strengthened to enable territorial food system strategies that connect production, consumption, health, education, social support and environmental management. This requires participatory, multi-actor governance spaces with clear mandates, stable resources and links to decision-making, so that territorial policy mixes can be assembled and adapted over time. Priority structures may include: (i) local or metropolitan food policy councils; (ii) municipal or intermunicipal food projects; and (iii) regional coordination schemes organised around “food basins”. Participation should be safeguarded through minimum representation and transparency standards—explicitly including small and conventional family farms—to reduce the risk of capture by already advantaged actors. Concrete measures may include:

- Identifying and supporting territorial conveners (e.g., municipalities, cooperatives, community organisations, NGOs, schools, health services) to co-develop local food strategies, with funding linked to clear territorial objectives and measurable follow-up.
- Establishing or strengthening local and regional food councils with dedicated facilitation capacity, so they can coordinate across sectors and host structured deliberation processes (including intergenerational and school-linked programmes where relevant).
- Defining participation rules as part of programme design (minimum representation, rotation, transparency requirements, and accessible formats), so that governance bodies remain open to diverse farm profiles and social actors and do not default to already networked participants.

8. Create a national monitoring and learning framework for agroecological transition. Develop a national monitoring system for agroecological transition that: (i) uses indicators on ecological performance, economic viability, social conditions and

public-health outcomes (including dietary patterns and protein sources); (ii) follows different types of farms over time (e.g., agroecological, proto-agroecological and conventional configurations), allowing assessment of movement along transition pathways; (iii) is linked to a national observatory function (or equivalent institutional arrangement) for sustainable food systems which synthesises data and supports policy review. Evaluation should be participatory, with periodic feedback to territorial governance bodies and farmer organisations. Given that evaluation design choices can influence results, the indicator set and aggregation rules should be transparent and co-developed with stakeholders. Concrete measures may include:

- Developing budget-tagging and impact-assessment tools to produce evidence on the costs and benefits of agroecological transition across ministries and public programmes, and to inform periodic reorientation of funds.
- Establishing territorial “knowledge and innovation hubs” connecting universities, research centres and farmers, combining scientific research with farmers’ experiential knowledge and hosting participatory evaluation of pilot projects.
- Using the farm-level assessment framework and farmer typologies to track different types of farms over time, capturing how each respond to policy changes and territorial initiatives.
- Making monitoring results publicly available and usable in local and regional governance arenas, so that data feeds back into learning-oriented adjustment of CAP-type instruments and national strategies.

9. Ensure a just transition for family farming. Across all measures, family farms—including conventional farms in structurally vulnerable situations—should be treated as central actors and beneficiaries. This requires: (1) reducing administrative barriers and transaction costs that disproportionately affect small and diversified farms; (2) using tailored schemes to support family farming on transition pathways; (3) ensuring that family-farmer organisations, including those not yet engaged in agroecology, are represented in national and territorial governance spaces. Just transition principles should be operationalised through measurable equity criteria and monitored across farmer typologies over time. Concrete measures may include:

- Designing public policy instruments specifically targeted at family farming, recognising its multiple economic, social and ecological functions and its potential role in agroecological transitions.

- Valuing and recognising farmers' knowledge as a key resource, for example through its formal inclusion in extension services, participatory research, governance bodies and public communication on food and agriculture.
- Ensuring that family farmers—including conventional and structurally vulnerable farms—are represented in territorial food councils, inter-municipal structures and national advisory bodies on agroecology and food policy.
- Combining simplified administrative procedures, tailored support schemes and better access to land and local markets for family farms that engage in agroecological practices or are on defined transition pathways.

Taken together, these recommendations propose a typology-sensitive and territorially grounded agenda for agroecological transition in Portugal. They connect definition and governance (Recommendations 1–2) with implementation levers (3–7) and a monitoring/learning backbone (8), under explicit just-transition design rules (9). They are meant to be discussed, adapted and enhanced in each territory—Tavira, Lisbon, Viseu and beyond— through participatory feedback processes that convene food system actors from production to consumption.

References

Bonisoli, L., Galdeano-Gómez, E., & Piedra-Muñoz, L. (2018). Deconstructing criteria and assessment tools to build agri-sustainability indicators and support farmers' decision-making process. *Journal of Cleaner Production, 182*, 1080–1094. https://doi.org/10.1016/j.jclepro.2018.02.055

Cartagena, L. B., Hegger, D., Tittonell, P., & Runhaar, H. (2025). How transformative is agroecological knowledge co-creation? Insights from a systematic literature review. *Agroecology and Sustainable Food Systems, 49*(1), 124–150. https://doi.org/10.1080/21683565.2024.2405885

Cassart, P., Frei, A., Hauggaard-Nielsen, H., Rasmussen, H. K., Swartebroeckx, A., Froidmont, E., Stilmant, D., & Rossing, W. A. H. (2025). A heuristic framework to portray agroecological transition initiatives in reflexive arrangements, illustrated with a conservation agriculture network in Denmark. *Ecology and Society, 30*(2), Article 10. https://doi.org/10.5751/ES-15770-300210

Clément, C., Labarthe, P., & Plumecocq, G. (2023). The everyday work of farm advisors as interface bureaucrats in greening French agricultural policies. *Journal of Political Ecology, 30*(1), 894–916. https://doi.org/10.2458/jpe.5450

de Olde, E. M., Oudshoorn, F. W., Sørensen, C. A. G., Bokkers, E. A. M., & de Boer, I. J. M. (2016). Assessing sustainability at farm-level: Lessons learned from a comparison of tools in practice. *Ecological Indicators, 66*, 391–404. https://doi.org/10.1016/j.ecolind.2016.01.047

Dinis, I. (2024). Examining disparities in Common Agricultural Policy direct payments among farming systems: Evidence from Portugal. *Agricultural and Food Economics, 12*, Article 7. https://doi.org/10.1186/s40100-024-00299-6

Frank, L., & Schanz, H. (2025). Policy for regime destabilisation in CAP Strategic Plans: Assessing the transformative ambition of France's and Germany's implementations of the Common Agricultural Policy. *Environmental Politics*. Advance online publication. https://doi.org/10.1080/09644016.2025.2523101

Gava, O., Povellato, A., Galioto, F., Prazan, J., Schwarz, G., Quero, A. L., Iragui, U. Y., Massa, C. A., Zilans, A., & Carolus, J. (2022). Policy instruments to support agroecological transitions in Europe. *EuroChoices, 21*(3), 13–20. https://doi.org/10.1111/1746-692X.12367

Gava, O., Vanni, F., Schwarz, G., Guisepelli, E., Vincent, A., Prazan, J., Rainer-Weisshaidinger, R., Frick, R., Hrabalová, A., Carolus, J., Iragui, U. Y., Pyysiäinen, J., Smyrniotopoulou, A., Vlahos, G., Balázs, K., Szilágyi, A. J., Jegelevičius, G., Mikšytė, E., Zilans, A., Frățilă, M., Röös, E., Miller, M., & Povellato, A. (2025). Governance networks for agroecology transitions in rural Europe. *Journal of Rural Studies, 114*, Article 103482. https://doi.org/10.1016/j.jrurstud.2024.103482

Gliessman, G. (2016). Transforming food systems with agroecology. *Agroecology and Sustainable Food Systems, 40*(3), 187–189. https://doi.org/10.1080/21683565.2015.1130765

Huber, R., Bartkowski, B., Brown, C., El Benni, N., Feil, J.-H., Grohmann, P., Joormann, I., Mitter, H., Müller, B. (2024). Farm typologies for understanding farm systems and improving agricultural policy. *Agricultural Systems, 213*, Article 103800. https://doi.org/10.1016/j.agsy.2023.103800

Lamine, C., Pugliese, P., Barataud, F., Berti, G., & Rossi, A. (2023). Italian biodistricts and French territorial food projects: How science–policy–experience interplays shape the framings of transitions towards sustainable territorial food systems. *Frontiers in Sustainable Food Systems, 7*, Article 1223270. https://doi.org/10.3389/fsufs.2023.1223270

López-García, D. (2020). Who is the subject of agroecological transitions? Local agroecological dynamisation and the plural subject of food systems transformation. *Journal of Sustainable Organic Agriculture Systems, 70*(2), 36–42. https://doi.org/10.3220/LBF1606213050000

López-García, D., & González de Molina, M. (2021). An operational approach to agroecology-based local agri-food systems. *Sustainability, 13*(15), Article 8443. https://doi.org/10.3390/su13158443

López-García, D., Vázquez-Macías, G., García-Fernández, J., Schmitt, M., Ortega-Faura, P., & Espluga-Trenc, J. L. (2023). Towards a politics of recognition: Exploring the symbolic contexts of material agroecological transitions. *Sustainability, 15*, Article 10091. https://doi.org/10.3390/su151310091

Lucas, V. (2021). A "silent" agroecology: The significance of unrecognized sociotechnical changes made by French farmers. *Review of Agricultural, Food and Environmental Studies, 102*, 1–23. https://doi.org/10.1007/s41130-021-00140-4

Moeller, N. M., Geck, M., Anderson, C., Barahona, C., Broudic, C., Cluset, R., Henriques, G., Leippert, F., Mills, D., Minhaj, A., Mueting-van Loon, A., Piers de Raveschoot, S., & Frison, E. (2023). Measuring agroecology: Introducing a methodological framework and a community of practice approach. *Elementa: Science of the Anthropocene, 11*(1), Article 00042. https://doi.org/10.1525/elementa.2023.00042

Petersen, P., & González de Molina, M. (2025). Food populism: The political language to build agroecology. *Agroecology and Sustainable Food Systems*. Advance online publication. https://doi.org/10.1080/21683565.2025.2582514

Rivera-Ferre, M. G. (2018). The resignification process of agroecology: Competing narratives from governments, civil society, and intergovernmental organizations. *Agroecology and Sustainable Food Systems, 42*(6), 666–685. https://doi.org/10.1080/21683565.2018.1437498

Rosset, P. M., & Altieri, M. A. (2017). *Agroecology: Science and politics*. Practical Action Publishing. https://doi.org/10.3362/9781780449944

Teixeira, H. M., Van den Berg, L., Cardoso, I. M., Vermue, A. J., Bianchi, F. J. J. A., Peña-Claros, M., & Tittonell, P. (2018). Understanding farm diversity to promote agroecological transitions. *Sustainability, 10*(12), Article 4337. https://doi.org/10.3390/su10124337

Wezel, A., Herren, B. G., Kerr, R. B., Barrios, E., Gonçalves, A. L. R., & Sinclair, F. (2020). Agroecological principles and elements and their implications for transitioning to sustainable food systems: A review. *Agronomy for Sustainable Development, 40*, Article 40. https://doi.org/10.1007/s13593-020-00646-z

ANNEX 1 | Questionnaire administered to family farmers and the TAPE indicator matrix – Article 1

ANEXO 1: Questionário aplicado aos agricultores familiares no âmbito do projeto Valorizar a Agricultura Familiar com a inclusão das questões TAPE assinaladas a azul

CONSENTIMENTO INFORMADO, LIVRE E ESCLARECIDO PARA PARTICIPAÇÃO EM INVESTIGAÇÃO

Por favor, leia com atenção a seguinte informação. Se achar que algo está incorreto ou que não está claro, não hesite em solicitar mais informações. Se concorda com a proposta que lhe foi feita, queira assinar este documento.

O presente questionário irá contribuir para a realização de 5 estudos regionais que permitam a valorização das funções sociais, económicas e ambientais da agricultura familiar nos distritos de Braga, Viseu, Castelo Branco, Setúbal e Évora. No âmbito das funções sociais, abordam-se o acesso e distribuição dos bens e produtos associados à exploração agrícola e aos agroecossistemas, apropriados e usufruídos pelos agricultores e por outros segmentos da sociedade, e ainda um conjunto de parâmetros que contribuem para a qualidade de vida. As funções económicas referem-se aos resultados económicos obtidos pelos agricultores ao nível do rendimento da exploração/família, a importância da produção para o autoconsumo, bem como as estratégias de comercialização. Quanto às funções ambientais procura-se avaliar a dimensão ecológica/ambiental associada à agricultura familiar no que diz respeito à manutenção e conservação dos ecossistemas, a partir dos processos de uso dos recursos (bens e serviços) naturais disponíveis – terra, água, biodiversidade, paisagem. Assim, gostaríamos que respondesse a este questionário, que está estruturado em quatro partes: (1) funções sociais, (2) económicas e (3) ambientais da agricultura familiar, e (4) caracterização sociodemográfica do agregado familiar.

A participação neste estudo é de carácter voluntário, pelo que pode desistir a qualquer momento, sem consequências, não sendo necessário dar qualquer justificação.

Este projeto está em conformidade com diretrizes e princípios éticos, nacionais e internacionais, entre as quais se incluiu o quadro geral de proteção de dados consignado no Regulamento EU 2016/679 (RGPD). Assegurando o seu anonimato, não sendo solicitados quaisquer dados que pretendam levar à sua identificação pessoal. Esta investigação respeita a privacidade dos entrevistados, cujo consentimento prévio é solicitado, garantindo a segurança e a confidencialidade das informações prestadas. Os dados recolhidos através deste questionário destinam-se única e exclusivamente para fins académicos e não serão partilhados com quaisquer entidades terceiras, nem se pretende a identificação pessoal e/ou profissional dos inquiridos. Demora cerca de 40 minutos a ser respondido e não existem respostas certas ou erradas.

Agradecemos a sua colaboração na resposta ao questionário, sendo um valioso contributo na prossecução deste trabalho, mas sobretudo para a valorização da agricultura familiar e dos seus contributos para a sociedade em geral!

Declaração do responsável pela entrevista

Foram dadas as explicações de forma adequada e inteligível nos procedimentos deste documento. O participante pode interromper ou mesmo desistir, caso sinta necessidade ou vontade de o fazer, sem que daí advenha qualquer prejuízo. Informei que para conforto e respeito da privacidade do participante, os dados que irá fornecer, permanecerão confidenciais e anónimos.

Nome legível do responsável pela entrevista:

Contato institucional do responsável pela entrevista | Mail:

Declaração do participante

Declaro ter compreendido os objetivos do estudo. Foi-me garantida a possibilidade de, em qualquer altura, recusar participar neste estudo sem qualquer tipo de consequências. Desta forma, aceito participar neste estudo e permito a utilização dos dados que de forma voluntária forneço, confiando em que apenas serão utilizados para esta investigação e nas garantias de confidencialidade e anonimato que me são dadas pelo/a investigador/a.

Nome: |_____|

… …/… …/… … … (data) *Assinatura* …

Nota: Este documento é feito em duas vias – uma para o processo/estudo e outra para ficar na posse de quem consente

TAPE - DESCRIÇÃO E CONTEXTO DO SISTEMA PRODUTIVO			
Região		País	
Localização (município, região)		Coordenadas da Exploração	
Tipo/nome de sistema produtivo (agro/silvo/pastoril)			

Caracterização sociodemográfica da família			
		TITULAR DA EXPLORAÇÃO	
Sexo (feminino – F, masculino – M)			
		Próprio	Cônjuge
Idade			
Escolaridade (não sabe ler/escrever, 4º ano/classe, 6º ano, 9º ano, ensino secundário/liceu, ensino superior)			
Os seus pais eram/são agricultores?		☐ NÃO ☐ SIM	
Tem formação profissional agrícola?		☐ NÃO ☐ SIM	
É agricultor a tempo integral?		☐ NÃO ☐ SIM	
Foi sempre agricultor?		☐ NÃO ☐ SIM	
Se teve ou tem outra profissão, indique qual			
Situação face ao emprego/ profissão	☐ Trabalhador por conta própria com empregados ☐ Trabalhador por conta própria sem empregados ☐ Trabalhador por conta de outrem	☐ Trabalhador familiar não remunerado ☐ Desempregado ☐ Reformado ☐ Outra. Qual?	
Tem atividade fiscal como agricultor?		☐ NÃO ☐ SIM	
Qual o rendimento mensal da família?		☐ 665€ ou menos ☐ De 665€ a 1065 € ☐ Mais de 1065€	
Quantas pessoas contribuem para este rendimento?			
Quantas pessoas do agregado vivem na exploração (nº e idade) Idosos, Homens, Mulheres, Jovens (15 a 24 anos) Crianças			
Número de elementos do agregado desempregado:			
Quantas pessoas do agregado trabalham na exploração (nº e idade) idosos, Homens, Mulheres, Jovens (15 a 24 anos) Crianças			
Número de trabalhadores externos contratados (últimos 12 meses)			
Já ensinou práticas e ou/ conhecimento agrícola a pessoas jovens (40 anos ou menos)?		☐ NÃO ☐ SIM	
Tem estatuto de agricultor familiar:		☐ NÃO ☐ SIM	
Se sim, desde quando?			
Se já teve benefícios?		☐ NÃO ☐ SIM	
Pode referir algum desses benefícios?			

TEM ACESSO A CRÉDITO?	HOMEM	MULHER
É possivel, em canais oficiais e seguros (banco ou similar)		
É possivel, em canais não-oficiais		
Não é possivel, o acesso ao crédito é demasiado difícil e arriscado		

Funções sociais				
Lazer, cultura				
É membro de alguma associação, coletividade ou organização? *Incluir ONGs*	☐ NÃO ☐ SIM			
Se sim, qual(is) e que função(ões) desempenha?				
	Nunca	Raramente (1 vez por ano)	Muita frequência (1 vez por mês)	Sempre (1 vez por semana)

Em quais atividades culturais, organizações coletividades participa?	Religiosas	①	②	③	④
	Musicais	①	②	③	④
	Desportivas	①	②	③	④
	Grupos políticos	①	②	③	④
	Cooperativas ou associação de agricultores/trabalhadores rurais	①	②	③	④
	Associações e organizações de mulheres (caso seja mulher ou no caso da sua cônjuge)	①	②	③	④
	Outras: Quais?	①	②	③	④
Costuma ir ao cinema, teatro, museus?		①	②	③	④

Acha que existem atividades culturais disponíveis suficiente na região onde reside?	☐ NÃO ☐ SIM
Consegue realizar uma semana de férias, por ano, fora de casa, para todos os membros do agregado? (despesa de alojamento e viagem)	☐ NÃO ☐ SIM
Costuma participar em feiras e exposições agrícolas?	☐ NÃO ☐ SIM
Se sim, como?	☐ Visitante ☐ Expositor/Vendedor ☐ Ambos

Saúde

Tem algum problema de saúde recorrente/crónico?	☐ NÃO ☐ SIM
Alguma vez se magoou enquanto trabalhava na agricultura?	☐ NÃO ☐ SIM
Como se magoou?	☐ Acidente com trator/alfaia ☐ Intoxicação ☐ Lesão de esforço ☐ Outro. Qual?
Alguma vez ficou impossibilitado de trabalhar na agricultura devido a problemas de saúde?	☐ NÃO ☐ SIM
Durante quanto tempo ficou impossibilitado de trabalhar?	
A que distância está o centro de saúde da sua casa?	☐ menos de 1 km ☐ 15 a 30km ☐ 1 a 15km ☐ Mais de 30km
Recorre a medicinas alternativas	☐ NÃO ☐ SIM. Quais?
De uma forma geral, como considera o seu estado de saúde?	□ Ótima □ Boa □ Má □ Muito Boa □ Razoável
Tem a vacina contra o tétano atualizada?	☐NÃO ☐ SIM | Ano da última inoculação _____
No último ano fez a vacina da gripe? COVID?	☐NÃO ☐ SIM
Na sua última visita ao centro de saúde diga-nos, por favor, qual o motivo	☐ Consulta de vigilância ☐ Vacinação ☐ Tratamentos ☐ Acompanhar familiar / pessoa significativa ☐ Pedir receitas | exames ☐ Outro

Transportes

Tem meio de transporte pessoal?	☐ NÃO ☐ SIM
Se sim, qual?	☐ Carro ☐ Mota ☐ Bicicleta ☐ Outro. Qual?
Tem acesso a transportes públicos perto de casa?	☐ NÃO ☐ SIM. Se sim, qual(is)?
Vai com frequência à(s) cidade (s) mais próxima(s)?	☐ NÃO ☐ SIM
Quais os motivos?	
Se sim, qual a periodicidade?	
(e não tiver filhos, passe pare o grupo de questões "Habitação"	
A que distância se situa a escola?	☐Entre 1 a 15km ☐Entre 15 e 30km ☐ Mais de 30km
Os seus filhos frequentam a escola?	☐ NÃO ☐ SIM
Que transporte utiliza para os deslocar à escola?	☐Carro pessoal ☐Transporte público ☐ Outro, qual?

Habitação

A sua casa	☐ é nova ☐ foi renovada recentemente ☐ precisa de obras
Se precisa de obras, indique quais.	
De onde vem a água de uso doméstico?	☐ companhia ☐ poço ☐ fonte ☐ Outro, qual?
Que tipo de energia dispõe na sua habitação?	☐ eletricidade ☐ gás ☐ solar ☐ outro, qual?
Consegue manter a casa aquecida?	☐ NÃO ☐ SIM

Tem máquina de lavar roupa?	☐ NÃO ☐ SIM
Possui saneamento?	☐ NÃO ☐ SIM
Qual é o destino do lixo doméstico?	☐ reciclagem ☐ lixo orgânico comum ☐ compostagem ☐ outro, qual?
Possui acesso à internet em casa?	☐ NÃO ☐ SIM. Se não, qual o motivo?
Que equipamentos informáticos possui?	☐ computador ☐ impressora ☐ telemóvel ☐outro

Género

Relativamente às tarefas de casa, quem as realiza? *Marcar todas as respostas indicadas*	☐ Eu ☐ Cônjuge ☐ Pais, tios e/ou avós	☐ Filho(s) ☐ Filhas(s) ☐ Todos	☐ Empregado/a doméstica ☐ Outra situação
Sente que seu trabalho doméstico e/ou agrícola é desvalorizado?	☐ NÃO ☐ SIM		

TOMADA DE DECISÃO	Mulher	Homem	Os dois	Alguém de fora
Quem normalmente toma as decisões sobre a PRODUÇÃO DE CULTURAS e ESCOLHA DE SEMENTES?				
Quem normalmente toma as decisões sobre a PRODUÇÃO DOS ANIMAIS?				
Quem normalmente toma as decisões acerca dos PRINCIPAIS BENS DA FAMÍLIA (Casa, máquinas agrícolas, etc)?				
Quem normalmente toma as decisões acerca dos PEQUENOS BENS DA FAMÍLIA (pequenas ferramentas, jardim, etc)?				

MULHER

PERCEPÇÕES SOBRE A TOMADA DE DECISÃO	Penso que não posso tomar nenhuma decisão	Só em decisões pequenas	Em algumas decisões	Na maioria/totalidade das decisões
Se quisesse, acha que poderia tomar decisões sobre a PRODUÇÃO de CULTURAS e ESCOLHA DE SEMENTES?				
Se quisesse, acha que poderia tomar decisões sobre a PRODUÇÃO DE ANIMAIS?				
Se quisesse, acha que poderia tomar decisões sobre as OUTRAS ATIVIDADES ECONÓMICAS da exploração?				
Se quisesse, acha que poderia tomar decisões sobre as GRANDES DESPESAS DA EXPLORAÇÃO?				
Se quisesse, acha que poderia tomar decisões sobre as DESPESAS DA EXPLORAÇÃO DE MENOR DIMENSÃO?				

Tomada de decisão sobre RENDIMENTOS	Não contribuiu ou contribuiu em poucas decisões	Contribuiu em algumas decisões	Contribuiu na maioria das decisões
Quanto contribuiu para as decisões sobre o uso da RECEITA gerada através da PRODUÇÃO de CULTURAS?			
Quanto contribuiu para as decisões sobre o uso da RECEITA gerada através da PRODUÇÃO de ANIMAIS?			
Quanto contribuiu para as decisões sobre o uso da RECEITA gerada através da OUTRAS ATIVIDADES ECONOMICAS?			

JOVEM EMPREGO E RAZÕES PARA O EXODO RURAL

Para cada um dos Jovens (15 34 anos) que vive e/ou trabalha na exploração (incluindo os que saíram da exploração e que vivem atualmente fora) especifique

dade	Masculino ou feminino	Este jovem saiu da exploração porque?	Se não saiu da exploração qual é a ocupação do jovem? (*trabalho e estudo)*	Este jovem gostaria de ser agricultor no futuro?
				☐NÃO ☐ SIM
				☐NÃO ☐ SIM
				☐NÃO ☐ SIM

Funções económicas				
Caracterização da exploração				
Concelho/ Freguesia da exploração:				
A exploração é própria?	☐ NÃO ☐ SIM			
De que forma adquiriu a propriedade?	☐ Herança ☐ Arrendamento fixo ☐ Arrendamento de campanha	☐ Parceria ☐ Cedência gratuita ☐ Compra		
Se foi por herança, qual foi a origem?	☐ Casamento ☐ Pais para filhos	☐ Filhos para pais ☐ Outros familiares. Quais?		
Quem é o dono da exploração	☐ Homem ☐ Mulher ☐ Outro, qual:			
A quem pensa deixar a exploração?				
Área da exploração:				
Número de parcelas agrícolas:		Distância média entre parcelas (km):		
Número de parcelas agrícolas cultivadas				
Se sim, porque não cultiva as restantes?	☐ Falta de mão-de-obra ☐ Falta de mercado	☐ Falta de acessos ☐ Outra. Qual?		
Produção vegetal (*responder apenas se tiver produção vegetal*) Referente às principais culturas de produção vegetal da exploração				
Nome da espécie ou tipo de cultura	Total da Produção (Kg)	Quant. vendida (Kg)	Preço na exploração (€/Kg)	Área cultivada (ha)
Qual é o principal objetivo da produção?	☐ venda ☐ autoconsumo ☐ para familiares/amigos			
Venda/comercialização (*responder apenas se vender*)				
Que parte da produção vende?	☐ um quarto ☐ um terço	☐ metade ☐ mais de metade	☐ toda a produção	
Onde vende?	☐ mercado ☐ feira	☐ mercearia ☐ supermercado	☐ cooperativa ☐ outro. Qual?	
Qual é a periodicidade da venda?				
Quem determina o preço de venda (normalmente)?	☐ o próprio ☐ o comprador/entidade	☐ os dois		
Quanto gasta mensalmente para produzir?	☐ De 0€ a 50€ ☐ De 50€ a 100€	☐ De 100€ a 150€ ☐ De 150€ a 250€	☐ De 350€ a 550€ ☐ Mais de 350€	
Produção animal (*responder apenas se tiver produção animal*) - ☐ TEM ☐ NÃO TEM				
Tipo	☐ Bovinos ☐ Caprinos ☐ Ovinos ☐ Coelhos ☐ Aves ☐ Outros. Quais?			
Dimensão do efetivo (número)				
Aptidão produtiva	☐ carne ☐ leite ☐ lã ☐ ovos ☐ outro. Qual?			
Como alimenta os seus animais	☐ ração ☐ ração e pastagem ☐ pastagem			
Espécie animal criada	Número total de animais dessa espécie criado na exploração neste ano	Número total de animais dessa espécie nascidos nos últimos 12 meses.	Número de animais vendidos	Preço de venda na exploração (€/kg)

Venda/comercialização produtos animais (*responder apenas se vender*)				
Produto animal vendido	Unidade e medida do produto (Kg, L, outro)	Total da quantidade produzida	Quantidade vendida	Preço de venda na exploração (€/unidade de medida)

Que parte da produção vende?	☐ um quarto ☐ um terço	☐ metade ☐ mais de metade	☐ toda a produção
Onde vende?	☐ mercado ☐ feira	☐ cooperativa ☐ outro. Qual?	
Qual é a periodicidade da venda?			
Quem determina o preço de venda (normalmente)?	☐ o próprio ☐ o comprador/entidade	☐ os dois	
Quanto gasta mensalmente para produzir?	☐ De 0€ a 50€ ☐ De 50€ a 100€	☐ De 100€ a 150€ ☐ De 150€ a 250€	☐ De 350€ a 550€ ☐ Mais de 350€

Total de despesas	
ALIMENTAÇÃO para auto-consumo	
SEMENTES	
FERTILIZAÇÃO	
PESTICIDAS DE SÌNTESE	
PESTICIDAS BIOLÓGICOS	
RAÇÕES	
SERVIÇOS DE VETERINÁRIO	
COMPRAS DE ANIMAIS	
TRABALHADORES EXTERNOS	
MAQUINARIA/EQUIPAMENTO e MANUTENÇÃO	
COMBUSTÍVEIS	
TRANSPORTES	
ENERGIA	
IMPOSTOS	
JUROS DE EMPRÉSTIMOS	
ALUGUER de TERRENOS	

Outras questões						
Tem outra atividade agrícola que dê origem a rendimento para a família?	☐ NÃO ☐ SIM Se sim, qual?					
O essencial da receita do agregado familiar vem de		quase nada (<25%)	pouco (25 a 50%)	metade (50%)	muito (50 a 75%)	quase todo (>75%)
agricultura						
de outras fontes (externas)						
Outras atividades/serviço produzido ou prestado		Designação			Receita	
Como compara os seus rendimentos comparativamente com os três anos anteriores?		☐ Mais rendimento ☐ Mesmo rendimento ☐ Menos rendimento				
Já recebeu algum tipo de apoios financeiros?	☐ NÃO ☐ SIM					

Quais?	☐ Créditos agrícolas ☐ Formação ☐ Outros. Quais? ☐ Subsídios Agrícolas ☐ Seguros
Tem tido dificuldade na obtenção destes apoios?	☐ NÃO ☐ SIM Se sim, quais?
Nos últimos 3 anos, realizou algum destes investimentos?	☐ Aquisição de alfaia agrícola nova ☐ Construção de armazém ☐ Melhorias no sistema de rega ☐ Aquisição de sementes melhoradas ☐ Projeto de investimento agrícola PDR2020

Autoconsumo – Segurança alimentar		
Qual é o número de pessoas do agregado familiar que consomem produtos da exploração?		
Que parte do que produz é consumida pelo agregado familiar?	☐ um quarto ☐ mais de metade ☐ um terço ☐ toda a produção ☐ metade	
Partilha a sua produção com familiares, vizinhos, amigos?	☐ NÃO Com quantos? ☐ SIM	
Que parte do que produz é partilhado com familiares, vizinhos, amigos?	☐ um quarto ☐ mais de metade ☐ um terço ☐ toda a produção ☐ metade	

DIVERSIDADE ALIMENTAR MÍNIMO PARA MULHERES		
GRUPOS ALIMENTARES E/OU ALIMENTOS	Sim, comi nas últimas 24 horas	Sim, comi na última semana
GRÃOS, RAÍZES BRANCAS e TUBÉRCULOS (pão, arroz, massa, farinha, batata branca, etc)		
LEGUMES (feijões, ervilhas, sementes frescas ou secas, lentilhas ou produtos de feijão/ervilha)		
NOZES e SEMENTES (nozes, amendoim ou certas sementes, "manteigas" ou pastas)		
PRODUTOS LÁCTEOS (leite, queijo, iogurte ou outros produtos lácteos,)		
PRODUTOS LÁCTEOS ou SEMELHANTES (manteiga, margarina ou natas		
CARNE, AVES, (carne bovina, suína, cordeiro, cabra, frango, órgãos de animais)		
PEIXES (peixe, frutos do mar, órgãos de animais exceto bacalhau		
BACALHAU		
OVOS de aves de capoeira ou de qualquer outra ave		
LEGUMES folhosos VERDE ESCURO (qualquer vegetal folhoso verde médio a escuro, incluindo folhas silvestres / forrageiras)		
FRUTAS E LEGUMES AMARELO-ESCURO ou LARANJA (abóbora, cenoura, abóbora, batata doce laranja)		
outros VEGETAIS (pepino, beringela, cogumelo, cebola, tomate, etc.)		
outras FRUTAS (abacate, maçã, abacaxi, etc.)		
AZEITE		
BEBIDAS AÇUCARADAS OU GASEIFICADAS		
PASTELARIA OU DOCES COMERCIAIS (não caseiros), como bolos, bolachas, biscoitos		
VINHO		

	SIM	NÃO
A cozedura, o guisado e/ou o grelhado são formas de preparação culinária que utiliza mais frequentemente que a fritura		
Consome preferencialmente frango, peru ou coelho em vez de vaca, porco, hambúrguer ou salsicha?		
Quantas vezes por semana consome hortícolas, massa, arroz ou outros pratos confecionados com um refogado?		
Consome preferencialmente produtos frescos, locais e da época?		

Jornada de trabalho

Número de elementos que trabalham na exploração	Familiares a tempo inteiro	Familiares a tempo parcial	Contratados a tempo inteiro	Contratados a tempo parcial

Os elementos da família são suficientes para manter a exploração?	☐ NÃO ☐ SIM	Porquê?

Quem realiza as seguintes tarefas naexploração? *(assinalar quais se diferentes)*	Homem		Mulher		Outros familiares	
	Sempre	Às vezes	Sempre	Às vezes	Sempre	Às vezes
Sementeira/ plantação						
Poda/Enxertia						
Monda/Desfolha/Tutoragem						
Colheita						
Aplicação de pesticidas/ fitofármacos						
Condução de trator e máquinas						
Condução de motocultivador						
Uso de motosserra/moto roçadora						
Uso de enxada/ foice e outra ferramenta						

CARGA HORÁRIA SEMANAL nº de horas gastas no trabalho da PRODUÇÃO AGRÍCOLA dentro da exploração	HOMEM	MULHER
Número de horas de trabalho na PRODUÇÃO AGRÍCOLA (dentro da exploração)		
Número de horas de trabalho na PREPARAÇÃO DE ALIMENTOS e outros TRABALHOS DOMÉSTICOS		
Número de horas de trabalho em OUTRAS ATIVIDADES REMUNERADAS (fora da produção agrícola)		

FUNÇÕES AMBIENTAIS

SISTEMA DE PRODUÇÃO

Modo de produção:	☐ Proteção integrada ☐ Produção integrada ☐ Agricultura biológica ☐Outro. Qual?
As suas parcelas estão divididas	☐ sebes ☐ muros ☐ cortaventos ☐ Outro. Qual?
A sua exploração tem inclinação	☐ reduzida (< 11º) ☐ média (11 a 30º) ☐ elevada (> 30º)
Faz rotação de culturas?	☐ NÃO ☐ SIM
Pratica consociações (ex: feijão e milho)?	☐ NÃO ☐ SIM
Faz pousio?	☐ NÃO ☐ SIM
Guarda e usa variedade/sementes regionais?	☐ NÃO ☐ SIM. Quais?
Quem guarda as sementes?	☐ homem ☐ mulher ☐ …….
Partilha sementes tradicionais com outras pessoas?	☐ familiares ☐ vizinhos ☐ amigos ☐ …….
Faz viveiro (alfobre) na exploração (couves, cebolo...)	☐ NÃO ☐ SIM
Faz compostagem?	☐ NÃO ☐ SIM
Na sua exploração encontra alguma destas árvores? *(Assinalar as que encontra)*	☐ Azinheira ☐ Sobreiro ☐ Carvalho ☐ Castanheiro ☐ Alfarrobeira ☐ Pinheiro-manso ☐ Oliveira ☐ Medronheiro ☐ outra espécie autóctone com interesse. Qual
Como aumenta a matéria orgânica do solo?	☐ restolho ☐ estrume ☐ composto ☐…….
Que tipo de estrume usa? Espécie(s):	
Local de armazenamento:	
Usa fertilizantes químicos?	☐ NÃO ☐ SIM
Faz correção do solo – calagem (uso de cal)?	☐ NÃO ☐ SIM
Quando pega num pedaço de solo, ele	☐ desfaz-se na mão ☐ deixa com barro ☐ forma um bloco
O solo das suas parcelas é	☐ branco/amarelo claro ☐ castanho ☐ castanho escuro/preto
O solo das suas parcelas é	☐ compacto *(bandeira dobra)* ☐compactação fina *(bandeira com resistência a entrar)* ☐ sem compactação *(bandeira entra sem resistência)*
A cobertura do solo nas suas parcelas?	☐Solo nú ☐ menos de 50%coberto ☐ mais de 50%coberto Solo coberto por: ☐ plástico ☐ palhas ☐ enrelvamento ☐ Outro. Qual?

Os resíduos orgânicos no solo das suas parcelas, estão	☐ em decomposição lenta ☐ Presença de resíduos do ano passado em decomposição) ☐ Resíduos em vários estágios de decomposição, a maioria bem decompostos
A retenção de água (nível de humidade após irrigação ou chuva) no solo das suas parcelas	☐ Solo seco, não retém água ☐Nível de humidade limitado disponível por um curto período de tempo ☐Nível de humidade razoável por um período de tempo razoável
A erosão nas suas parcelas de solo é:	☐ Erosão severa, presença de gretas ☐ Sinais de erosão evidentes, mas baixos ☐ Não há sinais visíveis de erosão
Encontra no solo alguns invertebrados?	☐ Sem sinais de presença ou atividade de invertebrados ☐ Presença de algumas minhocas e artrópodes ☐ Presença abundante de organismos invertebrados.
Nas suas parcelas de solo a atividade microbiológica revela-se:	☐ Muito pouca efervescência após a aplicação de água oxigenada ☐ Efervescência leve a média ☐ Efervescência abundante
Tem trator e máquinas agrícolas…	☐ Próprias ☐ alugadas ☐ partilhadas
Em média, quantas mobilizações do solo faz por ano?	
O seu trator tem cabine ou arco de proteção?	☐ NÃO ☐ SIM

Qual o destino dos seguintes resíduos agrícolas:	Queima	Abandono (no solo, caminhos)	Ecoponto/ Ecocentro/ Recolha	Não sabe / Não se Aplica
Pneus Usados				
Óleos Usados				
Sucatas				
Pilhas e Baterias				
Plásticos				

Indique uma espécie (animal, planta, fungo) que costumava ver na sua exploração e já não vê.	
Indique uma espécie de animal, planta, fungo, selvagem que ainda vê habitualmente na sua exploração.	
Na proteção das culturas usa	☐ Luta biológica (utilização de organismos benéficos para o controle biológico como a presença de joaninhas, outros insetos) ☐ Luta biotécnica (armadilhas, iscos alimentares, confusão sexual,) ☐ Luta cultural (desfolha, monda de frutos doentes, rotação de culturas e consociação etc) ☐ Luta química (pesticidas/ fitofármacos)
A quem pede conselho relativo ao usode produtos fitofármacos?	☐ Técnico da loja ☐ Vizinho ☐ Outro. Qual? ☐ Técnico na exploração ☐ Familiar ☐ Técnico da Associação de Agricultores

Nome do pesticida químico (utilizados nos últimos 12 meses)	Nível de toxicidade	Quantidade de produto utilizado (*l* ou *g*)	Utilizou na cultura toda ou só em parte	Em que culturas?	Para o tratamento de que praga?

Tem formação de aplicação de produtos fitofarmacêuticos?	☐ NÃO ☐ SIM
Que estratégias de mitigação, aplica	ϒ Máscara ☐ Proteção corporal (óculos, luvas, etc.) ϒ Avisa a comunidade sobre a realização de uma aplicação e riscos associados
Onde armazena os produtos fitofarmacêuticos?	
Tem feito a inspeção e manutenção dos pulverizadores?	☐ NÃO ☐ SIM
Lê o rótulo?	☐ NÃO ☐ SIM
O que faz às embalagens dos produtos fitofarmacêuticos ?	☐ Entrega na loja ☐ Queima ☐Lixo comum ☐Outro. Qual?
O que faz às embalagens de medicamentos veterinários (vazias ou fora do prazo)?	☐ Entrega na farmácia ☐ Lixo comum ☐Outro. Qual?

Para si, os produtos fitofarmacêuticos são	muito nocivos e a evitar	nocivos, mas podem-se usar	seguros (não fazem mal nenhum)	indispensáveis, mesmo que tóxicos

Alguma vez desenvolveu sintomas que associou à utilização de produtos fitofarmacêuticos?	☐NÃO ☐ SIM Quais?
Indique as técnicas tradicionais que ainda utiliza	
Como aprendeu as técnicas que referiu	
Indique as técnicas inovadoras que já utiliza *(sensores, etc*	

Nome do pesticida biológico (utilizados nos últimos 12 meses)	Origem: auto-produção ou compra?	Quantidade de produto utilizado (*l* ou *g*).	Área em que o pesticida foi utilizado (ha).	Em que culturas?	Para o tratamento de que praga?

Utiliza antibióticos na sua criação animal?	☐ Não utilizo antibióticos nenhum ☐ Utilizo apenas no tratamento de doenças ☐ Utilizo para a prevenção de doenças ☐ Utilizo para a prevenção de doenças e para estimular o crescimento ☐ Utilizo para estimular o crescimento

Água	
De onde vem a água que utiliza para a exploração?	☐ rio ☐ nascente ☐ poço ☐ lago ☐ barragem ☐ charca ☐ rede abastecimento ☐ outro

Práticas de extrativismo							
Pesca		Madeira		Raízes/bolbos		Outros:	
Caça		Resinas		Cogumelos			

Território e paisagem	
Qual o tipo de paisagem em que se insere a sua exploração?	☐ mosaico agrícola ☐ monocultura agrícola ☐ agricultura e floresta ☐ floresta
O que vê à volta da sua exploração?	☐ agricultura ☐ floresta ☐ estrada/caminhos ☐ construções ☐ parque natural
A sua exploração já alguma vez ardeu?	☐ NÃO ☐ SIM
Quantas vezes nos últimos 10 anos?	
Tem problemas com espécies invasoras na sua exploração?	☐ NÃO ☐ SIM Quais?

Como avalia a qualidade e a importância deste questionário / instrumento para o estudo em curso?				
[1. Nada importante a 4. Muito importante]	1	**2**	3	**4**
Considero que pensar sobre estes assuntos é importante				
Acho importante que me peçam opinião e me ouçam				
Estou satisfeito com a generalidade das perguntas que me foram realizadas				
Quero conhecer o resultado do estudo	☐ NÃO ☐ SIM			
Caso responda SIM, indique um contacto para onde possa ser enviado o resultado do estudo				
Observações				

ANNEX 2 | Questionnaire based on the constructed methodology administered to farmers and the indicator grid – Article 2

CONSENTIMENTO INFORMADO, LIVRE E ESCLARECIDO PARA PARTICIPAÇÃO EM INVESTIGAÇÃO

Por favor, leia com atenção a seguinte informação. Se achar que algo está incorreto ou que não está claro, não hesite em solicitar mais informações. Se concorda com a proposta que lhe foi feita, queira assinar este documento.

METODOLOGIA DE AVALIAÇÃO DAS EXPLORAÇÕES

O presente questionário e a recolha de amostras do solo surgem no âmbito de um projeto de investigação cujo objetivo é apoiar a transição agroecológica da Agricultura em Portugal. O estudo procura caracterizar a agricultura (agroecológica e convencional) e identificar os obstáculos e potencialidades para a sua transição agroecológica - os mecanismos para desbloquear os obstáculos e incentivar as potencialidades para a transição. Confiamos que, com essa informação, conseguiremos ajudar a desenhar políticas públicas de apoio à agroecologia em Portugal. Demora cerca de 90 minutos a ser respondido e não existem respostas certas ou erradas. Os dados recolhidos através deste questionário e nas amostras de solo após recolha serão codificados com código apenas conhecido pelo investigador principal não havendo assim nenhuma possibilidade de o identificar. Reforça-se que os dados recolhidos se destinam única e exclusivamente para fins académicos, incluindo a redação de artigos científicos e não serão partilhados com quaisquer entidades terceiras, nem se pretende a identificação pessoal e/ou profissional dos inquiridos. A sua participação é de carácter voluntário, pelo que pode desistir a qualquer momento, sem consequências, não sendo necessário dar qualquer justificação**.** Este projeto está em conformidade com diretrizes e princípios éticos, nacionais e internacionais, entre as quais se incluiu o quadro geral de proteção de dados consignado no Regulamento EU 2016/679 (RGPD), assegurando o seu anonimato, não sendo solicitados quaisquer dados que pretendam levar à sua identificação pessoal. Agradecemos a sua colaboração

Declaração do responsável pela entrevista

Confirmo que expliquei à pessoa abaixo indicada, de forma adequada e inteligível, os procedimentos necessários ao ato referido neste documento. Respondi a todas as questões que me foram colocadas e assegurei-me de que houve um período de reflexão suficiente para a tomada da decisão. Expliquei que pode pedir para interromper ou mesmo desistir, caso sinta necessidade ou vontade de o fazer, sem que daí advenha qualquer prejuízo. Informei **e reforcei** que para conforto e respeito da sua privacidade, os dados que me irá fornecer, permanecerão confidenciais, anónimos e serão destruídos imediatamente após publicação.

Nome legível do investigador responsável: Inês Costa Pereira
Contato institucional do responsável pela entrevista | Mail: inespereira@esav.ipv.pt

Parte declarativa da pessoa que consente

Declaro ter compreendido os objetivos de quanto me foi proposto e explicado pela/s pessoa/s que assina/m este documento. Foi-me dada oportunidade de fazer todas as perguntas sobre o assunto e para todas elas obtive resposta esclarecedora, tendo-me sido dado tempo suficiente para refletir sobre esta proposta. Foi-me garantida a possibilidade de, em qualquer altura, recusar participar neste estudo sem qualquer tipo de consequências. Desta forma, aceito participar neste estudo em toda a sua dimensão e permito a utilização dos dados que de forma voluntária forneço, confiando em que apenas serão utilizados para esta investigação e nas garantias de confidencialidade e anonimato que me são dadas pelo/a investigador/a.

Nome: |_____|
… …/… …/… … … (data) *Assinatura* …

SE NÃO FOR O PRÓPRIO A ASSINAR POR INCAPACIDADE OU POR NÃO SABER ASSINAR (Cf. Artigo 373.º do Código Civil)

NOME: …

DOC. IDENTIFICAÇÃO N.º .... DATA OU VALIDADE ….. /.…. /…....

… …

Assinatura a rogo

… …

Impressão digital

Qualquer dúvida ou esclarecimento relativo à proteção de dados deverá ser encaminhada para dpo@sc.ipv.pt

Nota: Este documento é feito em duas vias – uma para o processo/estudo e outra para ficar na posse de quem consentiu

CARACTERIZAÇÃO EXPLORAÇÃO			
Localização (município/freguesia)		Coordenadas da Exploração	

1. PRODUÇÃO VEGETAL: diversidade cultural no espaço e ao longo do tempo			
Modo de produção na sua exploração agrícola:	☐ convencional ☐ produção integrada ☐ MPB	☐permacultura ☐sist. agroflor sucessão/sintrópica ☐biodinâmica	☐regenerativa ☐outro. Qual?
Modo de produção dos seus vizinhos			

Nome da espécie ou tipo de cultura *(Hortícolas/ Frutícolas/ Vinha/ Olival/Pastagem e/ou Forragem/ Cereais)*	Área cultivada *(ha)*	Nº de variedades produzidas *(exemplos)*	Total da Produção *(Kg)*	Quantidade vendida *(%)*

Sabe o nome de quantas plantas *(sem ser hortícolas)*	☐ mais de 10	☐ mais de 20	☐ mais de 30
Lembra-se se os seus pais/avós lhes davam algum uso?	☐NÃO ☐ SIM		
Caso sim, pode dar algum exemplo?			
Considera que estas plantas são boas?	☐NÃO ☐ SIM		
Caso sim, porquê e para quê?			
Caso não, porquê?			
Caso tenha, qual é o papel das árvores na sua exploração?	☐ produção de fruta ☐ produção de madeira ☐ produção de forragem ☐ produção de substâncias medicinais e/ou biopreparados outro:		
Utiliza as árvores também para?	☐ sombra para animais ☐ aumento da fertilidade do solo ☐ retenção de água ☐ barreira à erosão do solo outro:		

Faz rotação de culturas? *(duas ou mais culturas cultivadas uma após a outra)*	☐NÃO ☐ SIM
Caso sim, que tipo de rotação costuma fazer	☐com pastagem ☐com outras culturas, quais:
Faz pousio (*6 meses*)?	☐NÃO ☐ SIM
Tem diversidade de culturas entre linhas? *(várias culturas em linhas diferentes)*	☐NÃO ☐ SIM
Faz consociações/culturas intercaladas *(plantas diferentes ao mesmo tempo no mesmo campo ex: feijão e milho)*	☐NÃO ☐ SIM
Caso sim, pode dar algum exemplo	
Guarda e usa sementes de variedades regionais	☐ NÃO ☐ SIM Se sim, quais?
Caso sim, quem guarda as sementes	

Caso sim, que quantidade de sementes é autoproduzida e que quantidade é comprada	☐ todas as sementes que utilizo são autoproduzidas ☐ a maior parte das sementes que utilizo (75%) são autoproduzidas e uma parte pequena é comprada (25%) ☐ metade das sementes que utilizo é autoproduzida e a outra metade é comprada ☐ a maior parte das sementes que utilizo (75%) são compradas e uma parte pequena é autoproduzida (25%) ☐ todas as sementes que utilizo são compradas
Partilha sementes regionais com outras pessoas? *(familiares, vizinhos, amigos)*	☐ NÃO ☐ SIM Se sim, com quem?
Faz viveiro (alfobre) na exploração *(couves, cebolo...)*	☐ NÃO ☐ SIM Se sim, quais?

2. PRODUÇÃO ANIMAL: presença e diversidade de animais na exploração (bem-estar animal)

Espécie animal criada *(e se adaptada ou não às condições climáticas locais)*	Aptidão produtiva *(carne, leite, lã, ovos)*	Nº total de animais (dessa espécie) criados na exploração este ano	Nº total de animais (dessa espécie) nascidos nos últimos 12 meses	Nº de animais vendidos este ano (e valor)

Como alimenta os seus animais	☐ração ☐ ração e pastagem ☐ pastagem
Se alimenta os seus animais com ração e pastagem como é a sua distribuição	☐ a maior parte é ração (75%) e alguma pastagem (25%) ☐metade ração e metade pastagem ☐ a maior parte é pastagem (75%) e alguma ração (25%)
Se alimenta os seus animais com ração	☐compra toda a ração ☐compra a maior parte (75%) mas também produz (25%) ☐compra metade e produz a outra metade ☐produz a maior parte (75%) mas também compra (25%) ☐produz toda a ração
Os animais na sua exploração	☐sofrem com falta de água em períodos específicos *(p.e. no verão)* ☐sofrem com falta de alimento em períodos específicos *(p.e. no verão)* ☐outro, qual:
Onde adquire os animais *(pintos, animais jovens, sémen)*?	☐ todos no mercado ☐ a maior parte no mercado (75%), alguns autoproduzidos ou trocada com vizinhos (25%) ☐ metade no mercado e metade autoproduzida ou trocada com vizinhos ☐ a maior parte autoproduzido, trocado com vizinhos ou gerida coletivamente (75%), alguns comprados no mercado (25%) ☐ todos autoproduzidos, trocados com vizinhos ou gerida coletivamente
Utiliza antibióticos na sua criação animal	☐ não utilizo antibióticos nenhuns ☐ utilizo apenas no tratamento de doenças ☐ utilizo para a prevenção de doenças ☐ utilizo para a prevenção de doenças e para estimular o crescimento ☐ utilizo para estimular o crescimento
Pode listar os produtos que comprou/utilizou no ano passado?	
Onde é feito o abate dos seus animais?	
Como é feito o transporte dos animais para o abate?	

3. REGENERAÇÃO DO SOLO						
A sua exploração tem inclinação	☐ reduzida (< 11º)		☐ média (11º a 30º)		☐ elevada (> 30º)	
Após a colheita, o solo das suas culturas costuma ficar:	☐ 100%	☐ 75%	☐ 50%	☐ 25%	☐ 0%	nu
	☐ 100%	☐ 75%	☐ 50%	☐ 25%	☐ 0%	coberto com resíduos ou culturas de cobertura
	☐ 100%	☐ 75%	☐ 50%	☐ 25%	☐ 0%	outro:
Na sua exploração, para minimizar o declive tem	☐ 100%	☐ 75%	☐ 50%	☐ 25%	☐ 0%	Do solo em socalcos ou Linhas de cultura de acordo com a orografia do terreno
Para a sua cultura principal *(indique qual)* quantas operações de mobilização faz ao ano, e que operações faz						
Se utiliza outras práticas de conservação do solo, indique quais sff e em que % da sua exploração						
Tem trator e máquinas agrícolas	☐ próprias ☐ alugadas	☐ partilhadas, quais: Com quem:				
O seu trator tem cabine ou arco de proteção?	☐ NÃO ☐ SIM					
Que tipo de fertilizantes e corretores de solo utiliza mais frequentemente?	☐ origem animal *(estrume)*: ☐da exploração ☐comprado ☐ambos ☐ origem mineral *(para correção pH do solo, pe calagem, gesso)* ☐ origem vegetal *(restolho, composto, adubação verde, culturas de cobertura)* ☐ sintéticos *(obtidos industrialmente, pe granulados 10/10/10)* ☐ outro:					
Que tipo de estrume costuma usar? *Indicar de que espécie(s):*						
Que utilização dá e gostaria de dar ao estrume?						
Pode indicar a quantidade de estrume que é produzida pelos seus animais por mês *(aproximadamente)*						
Os seus pais/avós utilizavam estrume na exploração	☐NÃO ☐ SIM					
Caso sim, com que uso?						
Que quantidade de fertilizantes e corretores do solo é autoproduzida e que quantidade é comprada	☐ todos os fertilizantes e corretores do solo que utilizo são autoproduzidos ☐ a maior parte dos fertilizantes e corretores do solo que utilizo (75%) são autoproduzidas e uma parte pequena é comprada (25%) ☐ metade dos fertilizantes e corretores do solo que utilizo é autoproduzido e a outra metade é comprado ☐ a maior parte dos fertilizantes e corretores do solo que utilizo (75%) são comprados e uma parte pequena é autoproduzida (25%) ☐ todos os fertilizantes e corretores do solo que utilizo são comprados					
Pode listar os fertilizantes e corretores do solo que utilizou no ano passado na sua exploração?						
Já realizou análises ao solo?	☐NÃO ☐ SIM					
Caso sim, quando? *(solicitar para ver as análises e, se possível tirar fotografia)*						

4. REGENERAÇÃO DO CICLO DA ÁGUA	
De onde vem a água que utiliza para a exploração?	☐ rio ☐ nascente ☐ poço ☐ lago ☐ barragem ☐ charca ☐ rede abastecimento ☐ outro_____

Disponibilidade de água na exploração?	☐ sempre em falta ☐ em falta no verão ☐nunca falta ☐ sempre em excesso ☐em excesso no inverno ☐nunca em excesso
Que tipo de rega utiliza na sua exploração?	☐ gota-a-gota ☐ aspersão ☐ micro aspersão ☐ rego ☐ alagamento ☐ outra:_____
Reserva a água da sua exploração?	☐ tanques ☐ depósitos ☐ charca ☐ outra:_____
Conduz a água da sua exploração?	☐ caleiras ☐ canais ☐ levadas ☐ outra
Utiliza outras formas para limitar o uso da água	☐ NÃO ☐ SIM
Se sim quais?	
Faz tratamento da água na sua exploração?	☐ NÃO ☐ SIM
Se sim, como	

5. GESTÃO DE PRAGAS, DOENÇAS E INFESTANTES		
Na proteção das culturas usa	☐ Proteção biológica *(utilização de organismos benéficos para o controle biológico)*	☐ sebes ☐ faixas floridas/corredores biológicos *(para atrair joaninhas pe)* ☐ Plantas multifuncionais *(que ajudam as culturas)* , quais:_____ ☐ largadas ☐ joaninhas ☐ outros insetos:_____ ☐ outra:
	☐ Proteção biotécnica	☐ armadilhas ☐ iscos alimentares ☐ confusão sexual ☐ outra:
	☐ Proteção cultural	☐ desfolha ☐ eliminação de plantas e frutos doentes ☐ monda manual ☐ controlo manual de pragas ☐ rotação de culturas ☐ consociação ☐ cobertura do solo *(plástico/tela)* ☐ cobertura de solo com material natural *(mulching/ palha)* ☐ enrelvamento *(natural ou semeado)* ☐ outra:
	☐ Proteção química com aplicação de pesticidas de síntese	☐ herbicidas ☐ inseticidas ☐ fungicidas ☐ outra:
	☐ Proteção química com aplicação de bio pesticidas	☐ herbicidas ☐ inseticidas ☐ fungicidas ☐ biopreparados ☐ outra:
	☐ Nenhuma ação contra pragas, doenças e infestantes	

A quem pede conselhos sobre o uso dos produtos que utiliza?	☐ técnico da loja ☐ técnico na exploração ☐ técnico da Associação de Agricultores	☐ vizinho ☐ familiar ☐ outro:

Pode listar os produtos que comprou/utilizou no ano passado?	

Consegue medir os resultados dos tratamentos que fez?	☐ NÃO ☐ SIM Se sim, como?
Faz o registo das pragas, doenças e infestantes	☐ não faço registo nem sei de cabeça ☐ sei de cabeça ☐ tenho algum registo, mas não de tudo ☐ tenho o registo das pragas doenças e infestantes que apareceram na exploração nos últimos ___ anos

6. SINERGIAS ECOLÓGICAS		
Acha importante a presença de biodiversidade na sua exploração?	☐NÃO ☐ SIM	
Se sim, para haver biodiversidade na sua exploração quanto importante é a presença de: *Mamíferos, Aves, Répteis, Anfíbios, Insetos, Aranhas, Outros invertebrados, Fungos, Plantas silvestres*	muito ou algo importante	pouco ou nada importante

Destes grupos de invertebrados quais observa na sua exploração agrícola? *(utilizar fotografias de apoio)*	nunca	de vez em quando	às vezes	muitas vezes	sempre
crisopas					
joaninhas					
bichas- cadelas					
vespas					
abelhas					
moscas das flores					
formigas					
aranhas					
borboletas					
escaravelhos					
grilos e gafanhotos					
minhocas e bichos de conta					

Destes invertebrados indique sff 5 que considere	mais benéficos para a sua produção	mais prejudiciais para a sua produção

Tem na sua exploração espaços para a proteção ou incremento da agrobiodiversidade funcional	☐ ninhos para aves e morcegos ☐ ilhas ou faixas de flores	☐ poisos para rapinas ☐ abrigos de pedra ☐ outros, quais:
Caso sim	☐ tem um ou dois espaços, para experiência ☐ já tem alguns espaços, mais ainda pouco estruturados ☐ tem estes espaços em toda a exploração pensados como um todo ☐ outro, qual:	
Faz apicultura	☐ NÃO ☐ SIM	
Se sim, quantas colmeias tem?		

7. SINERGIAS ECONÓMICAS
FATORES DE PRODUÇÃO
ENERGIA

Utiliza algum tipo de energia autoproduzida?	☐ madeira ☐ biogás ☐ energia hidráulica ☐ energia eólica ☐ tração animal ☐ outra:
Que quantidade de energia utilizada é comprada?	☐ toda ☐ quase toda ☐ metade ☐ mais de metade ☐ nenhuma

RESÍDUOS

Que destino dá aos resíduos não orgânicos *(plásticos, metais)*	☐ reciclo todos os resíduos ☐ deito a maior parte dos resíduos para o lixo comum ☐ quando faço uma queimada, junto-lhe a maior parte dos resíduos ☐ normalmente os resíduos são descarregados ☐ outro:	
Que destino dá aos resíduos orgânicos?	☐ alimentação animal ☐ compostagem ☐ cobertura de solo ☐ lixo comum	☐ queimada ☐ incorporo diretamente na terra ☐ outro:

Considera a prática da compostagem em meio agrícola importante?	☐ NÃO ☐ SIM porquê?

Para si, a compostagem é importante porque	concordo totalmente	concordo parcialmente	discordo parcialmente	discordo totalmente	Não sei
Promove a fertilidade e qualidade dos solos					
Permite reduzir o desperdício e reaproveitar os resíduos orgânicos					
Promove a biodiversidade dos solos					
Permite a valorização económica dos resíduos					
Contribui para a produtividade agrícola					
Melhora a qualidade dos alimentos					

Faz compostagem?	☐ NÃO ☐ SIM	
Se não faz, porquê	☐falta de tempo ☐falta de espaço ☐falta de mão de obra ☐já tentei, mas sem sucesso	☐utilizo os resíduos para alimentação animal ☐não sei como o fazer ☐não é importante no contexto da minha produção ☐outro:
Se faz, estaria interessado em receber os resíduos orgânicos domésticos dos seus consumidores, para fazer composto?	☐ NÃO ☐ SIM	
Se respondeu sim, quais as condições necessárias?		

CARACTERIZAÇÃO DA EXPLORAÇÃO AGRÍCOLA

A exploração é própria?	☐ NÃO ☐ SIM		
De que forma adquiriu a propriedade?	☐ herança ☐ doação	☐ arrendamento ☐ parceria	☐ cedência gratuita ☐ compra
Quem é o dono da exploração	☐ homem	☐ mulher	☐ outro:
Área da exploração:		Número de parcelas agrícolas	
Como compara os seus rendimentos com os três anos anteriores?	☐mais rendimento	☐ mesmo rendimento	☐menos rendimento

		O essencial da receita do agregado familiar vem de *(somar para dar 100%)*	menos de um quarto (25%)	menos de metade (25 a 50%)	metade (50%)	mais de metade (50 a 75%)	quase tudo (>75%)
		agricultura					
de outras fontes (internas)		*turismo (aloj., atividades lúdicas, eventos)*					
		comércio e restauração					
		cursos de formação/workshops					
		outras fontes (externas)					

Qual o rendimento mensal da família?	☐760€ ou menos ☐ 1411€ a 2822€ ☐ 760€ a 1411€ ☐ 2822€ ou mais
Quantas pessoas contribuem para este rendimento?	

Quantas pessoas vivem na exploração *(nº e idade)*	
Tem estatuto de agricultor familiar:	☐ NÃO ☐ SIM, se sim desde quando:
Já teve subsídios/apoios?	☐ NÃO ☐ SIM
Se sim quais? *(ex jovem agricultor/medidas agroambientais)*	
Tem acesso a crédito?	☐NÃO ☐ SIM
Caso necessite, é-lhe fácil obter crédito *(ex: intempéries)*	☐NÃO ☐ SIM
Tem seguro agrícola?	☐NÃO ☐ SIM
Caso sim, o seguro cobre algum tipo de intempéries:	☐ NÃO ☐ SIM Caso sim, pode indicar quais:
Nos últimos 5 anos sofreu com alguma intempérie ou outro tipo de choque *(ex. incêndio, praga ou doença)*	☐ NÃO ☐ SIM Caso sim, pode indicar qual(is):
Quanto tempo demorou a recuperar depois do(s) choque(s)	
A comunidade local ajudou-o na recuperação	☐ NÃO ☐ SIM Caso sim, pode dar um exemplo:

VENDA/COMERCIALIZAÇÃO DA PRODUÇÃO VEGETAL (V) E/OU ANIMAL (A)			
Que parte da produção vende?	☐ menos um quarto	☐ um terço	☐ mais de metade
	☐ um quarto	☐ metade	☐ toda a produção
Vende através de alguma rede(s) *(OP's, cooperativas, associações)*	☐NÃO ☐ SIM		
Se sim, pode dar algum exemplo			
Faz parte dessa rede ou de outra? Se sim, qual o seu papel nessa rede?			
O que funciona melhor e pior nessa rede?			

Onde vende os seus produtos *(somar para dar 100%)*	menos de um quarto (25%)	menos de metade (25 a 50%)	metade (50%)	mais de metade (50 a 75%)	quase tudo (>75%)
Restauração (local/nacional/internacional)					
Distribuição					
Venda a retalho (local/nacional/internacional)					
Venda direta					
Outro, qual?					

Se diretamente, onde vende os seus produtos? *(somar para dar 100%)*	menos de um quarto (25%)	menos de metade (25 a 50%)	metade (50%)	mais de metade (50 a 75%)	quase tudo (>75%)
Na exploração					
Cabazes					
Mercados e feiras (locais/regionais/nacionais)					
Venda online					
Outro, qual?					

Qual é a periodicidade das vendas?	

Quem determina o preço de venda *(normalmente)*?	☐ o próprio ☐os dois ☐ o comprador/entidade
Quanto gasta mensalmente para produzir?	☐ de 0€ a 50€ ☐ de 100€ a 150€ ☐ de 350€ a 550€ ☐ de 50€ a 100€ ☐ de 150€ a 250€ ☐ mais de 550€
Como caracteriza a procura e escoamento dos seus produtos *(vegetais)*	☐ tenho dificuldades em escoar a produção ☐ consigo escoar a produção, mas a preços mais baixos ☐ consigo escoar toda a produção ao preço planeado ☐ tenho excesso de procura

VENDA/COMERCIALIZAÇÃO PRODUTOS NÃO PRODUZIDOS NA EXPLORAÇÃO			
Vende produtos agrícolas para além dos seus?	☐ NÃO ☐ SIM		
Caso sim, são de origem:	☐ local ou regional	☐ nacional	☐ internacional

Que produtos vende que não vêm da sua exploração?	☐ hortícolas ☐ frutícolas ☐ vinha ☐ olival	☐ gado e/ou produtos animais (carne, ovos, leite, queijo) ☐ pastagem e/ou forragem ☐ cereais ☐ outros:
Quais as razões para vender produtos de outras explorações?		

TOTAL DE DESPESAS NO ÚLTIMO ANO	
Alimentação para auto-consumo *(valor semanal/mensal)*	
Sementes	
Fertilização	
Pesticidas de síntese	
Pesticidas biológicos	
Rações	
Serviços de veterinário	
Compras de animais	
Trabalhadores externos	
Aluguer de maquinaria/equipamento e manutenção	
Combustíveis	
Transportes	
Energia	
Impostos	
Juros de empréstimos	
Aluguer de terrenos	

REGISTOS	
Faz o registo das plantações e/ou do nascimento dos animais	☐ não faço registo nem sei de cabeça ☐ sei de cabeça ☐ tenho algum registo, mas não de tudo ☐ tenho o registo do que plantei/colhi e vendi e dos animais que nasceram e foram vendidos nos últimos ___ anos

8. SINERGIAS SOCIAIS

CARACTERIZAÇÃO SOCIODEMOGRÁFICA		
Sexo do(a) inquirido(a) *(feminino/masculino/outro)*		
	próprio(a)	cônjuge
Idade		
Escolaridade		
Os seus pais eram/são agricultores?	NÃO ☐ SIM	
Tem formação profissional agrícola?	NÃO ☐ SIM	
É agricultor a tempo integral?	NÃO ☐ SIM	
Há quantos anos é agricultor?		
Se teve/ tem outra profissão, indique qual		

Situação face ao emprego/ profissão	☐ trabalhador por conta própria com empregados ☐ trabalhador por conta própria sem empregados ☐ trabalhador por conta de outrem	☐ trabalhador familiar não remunerado ☐ desempregado ☐ reformado ☐ outra. Qual?

Tem atividade fiscal como agricultor?	☐ NÃO ☐ SIM
Acha que os agricultores têm condições dignas de trabalho *(segurança e saúde no ambiente de trabalho)* e que recebem condignamente	☐ NÃO ☐ SIM
Se não, dê sff um exemplo	
Possui acesso à internet em casa?	☐ NÃO ☐ SIM. Se não, qual o motivo?

JORNADA DE TRABALHO

Número de elementos que trabalham na exploração *(referente ao último ano)*	Familiares a tempo inteiro	Familiares a tempo parcial	Contratados a tempo inteiro	Contratados a tempo parcial

Os elementos da família são suficientes para manter a exploração?	☐ NÃO ☐ SIM	Porquê?
Contrata mão de obra especializada para tarefas *(corte de cortiça, apanha de mirtilos, vindima, abate de animais)*	☐ NÃO ☐ SIM	Que tarefas?
Sente que estão bem preparados para executar as tarefas?		

Quem realiza as seguintes tarefas na exploração?	Homem		Mulher		Outro: familiares/contratados	
	Sempre	Às vezes	Sempre	Às vezes	Sempre	Às vezes
Sementeira/ plantação						
Poda/Enxertia						
Monda/Desfolha/Tutoragem						
Colheita						
Aplicação de pesticidas/ fitofármacos						
Condução de trator e máquinas						
Condução de motocultivador						
Uso de motosserra/moto roçadora						
Uso de enxada/ foice e outras ferramentas						
Tratar dos animais						

CARGA HORÁRIA	Mulher	Homem	Outro
Nº de horas por dia de trabalho na PRODUÇÃO AGRÍCOLA *(dentro da exploração)*			
Nº de horas por dia de trabalho na PREPARAÇÃO DE ALIMENTOS e outros TRABALHOS DOMÉSTICOS			
Nº de horas por dia de trabalho em OUTRAS ATIVIDADES REMUNERADAS *(fora da produção agrícola)*			
Nº de horas por dia de descanso *(incluindo horas de sono)*			

Consegue ir de férias, por ano, fora de casa, com todos osmembros do agregado? *(despesa de alojamento e viagem)*	☐ NÃO ☐ SIM
Se sim por quanto tempo	

EQUIDADE DE GÉNERO

tomada de decisão	Mulher	Homem	Os dois	Outro
Quem é o dono das CULTURAS e das SEMENTES?				
Quem normalmente toma as decisões sobre a PRODUÇÃO DE CULTURAS?				
Quem é o dono dos ANIMAIS?				

Quem normalmente toma as decisões sobre a PRODUÇÃO DOS ANIMAIS?				
Quem é o dono dos recursos para outras atividades económicas dentro da exploração?				
Quem normalmente toma as decisões acerca das outras atividades económicas da exploração?				
Quem é o dono da maioria dos PRINCIPAIS BENS DA FAMÍLIA *(casa, máquinas agrícolas, etc)*				
Quem normalmente toma as decisões acerca dos PRINCIPAIS BENS DA FAMÍLIA?				
Quem é o dono dos BENS DA FAMÍLIA SECUNDÁRIOS *(pequenas ferramentas, jardim, etc)*				
Quem normalmente toma as decisões acerca dos BENS DA FAMÍLIA SECUNDÁRIOS?				

Perceção sobre a tomada de decisão (mulher)	Penso que não posso tomar nenhuma decisão	Só em decisões pequenas	Em algumas decisões	Na maioria/totalidade das decisões
Se quisesse, acha que poderia tomar decisões sobre a PRODUÇÃO de CULTURAS e ESCOLHA DE SEMENTES?				
Se quisesse, acha que poderia tomar decisões sobre a PRODUÇÃO DE ANIMAIS?				
Se quisesse, acha que poderia tomar decisões sobre as OUTRAS ATIVIDADES ECONÓMICAS da exploração?				
Se quisesse, acha que poderia tomar decisões sobre as GRANDES DESPESAS DA EXPLORAÇÃO?				
Se quisesse, acha que poderia tomar decisões sobre as DESPESAS DA EXPLORAÇÃO DE MENOR DIMENSÃO?				

Tomada de decisão sobre Rendimentos (mulher)	Não contribuiu ou contribuiu em poucas decisões	Contribuiu em algumas decisões	Contribuiu na maioria das decisões
Quanto contribuiu para as decisões sobre o uso da RECEITA gerada através da PRODUÇÃO de CULTURAS?			
Quanto contribuiu para as decisões sobre o uso da RECEITA gerada através da PRODUÇÃO de ANIMAIS?			
Quanto contribuiu para as decisões sobre o uso da RECEITA gerada através da OUTRAS ATIVIDADES ECONOMICAS?			

Jovens *Para cada um dos Jovens (15/ 34 anos) que vivem e/ou trabalham na exploração (incluindo os que saíram da exploraçãoe que vivem atualmente fora)*

Idade	M/F	Este jovem saiu da exploração porquê?	Se não saiu da exploração qual é a ocupação do jovem? *(trabalho e estudo)*	Este jovem gostaria de ser agricultor no futuro?
				☐NÃO ☐ SIM
				☐NÃO ☐ SIM
				☐NÃO ☐ SIM

SEGURANÇA ALIMENTAR

Número de pessoas do agregado familiar que consome produtos da exploração?		
A produção da exploração agrícola dá para se alimentarem	☐NÃO ☐ SIM	
Partilha a sua produção com familiares, vizinhos, amigos?	☐ NÃO ☐ SIM	Se sim, quantos? (*nº aproximado)*

Com a produção da exploração há excedente para a compra de outros bens essenciais *(ex medicamentos, roupa, livros)*				☐NÃO ☐ SIM
Indique sff qual dos cabazes de produtos da sua horta se aproximam mais das quantidades que a sua família consome por semana *(apresentar ficha com descrição dos cabazes)*				
☐ Cabaz 1	☐ Cabaz 2	☐ Cabaz 3	☐ Cabaz 4	☐ Cabaz 5

9. SISTEMA ALIMENTAR LOCAL		
Existem algumas iniciativas do município para promover a venda de produtos locais *(Escolas, IPSS's)*		☐NÃO ☐ SIM
Se sim, pode dar um exemplo. E funciona bem ou mal?		
Existem algumas iniciativas locais e regionais de conexão entre agricultores para a pós-colheita, processamento, embalagem ou distribuição		☐NÃO ☐ SIM
Se sim, pode dar um exemplo. E funciona bem ou mal?		
Costuma participar em eventos locais *(participação igual de homens e mulheres)*		☐NÃO ☐ SIM
Se sim pode dar um exemplo		
Já foi chamado para participar em algum processo de tomada de decisão? *(governança da terra e recursos naturais)*		☐NÃO ☐ SIM
Se sim, dê um exemplo		
Caso não, em que casos gostaria de participar		
Sente que os agricultores têm algum poder de negociação para melhorar as suas condições de vida e/ou para desenvolver as suas competências		☐NÃO ☐ SIM
Se sim, dê um exemplo		
Caso não, em que casos gostaria de participar		

10. PARTILHA DE CONHECIMENTO		
Na sua região existe alguma tradição ou costume que seja valorizada/passada de geração em geração?		☐ NÃO ☐ SIM
Se sim, pode dar um exemplo		
Existe algum prato típico da sua região feito com variedades/raças locais que faça parte da sua dieta alimentar?		☐ NÃO ☐ SIM
Se sim, pode dar um exemplo		
Ainda fazem alguma festa /feira para a valorização destas tradições/costumes locais		☐ NÃO ☐ SIM
Se sim, pode dar um exemplo		
Tem o costume de partilhar o seu conhecimento com outros agricultores?		☐ NÃO ☐ SIM
Se sim, pode dar um exemplo		
Tem uma ideia sobre o que é agroecologia e costuma partilhar conhecimento sobre o tema		☐ NÃO ☐ SIM
Se sim, pode dar um exemplo		
Partilha conhecimento e experiências com outros agricultores através de alguma plataforma		☐ NÃO ☐ SIM

Se sim, indicar a plataforma e o tipo de agricultores com quem interage *(ex: jovens mulheres)*	

POLÍTICAS PÚBLICAS					
Para si, o que seria mais importante para ajudar os agricultores a optar por práticas agrícolas que aumentem a biodiversidade, a regeneração do solo e da água:					
Priorize sff dando o valor de 5 ao que acha mais importante e 1 ao menos importante	1 menos importante	2	3	4	5 mais importante
Que o **Estado crie impostos** para a aplicação de pesticidas de síntese química e outras práticas agrícolas prejudiciais para a biodiversidade, regeneração do solo e da água.					
Que o **Estado assegure a Certificação** dos produtos provenientes de práticas agrícolas que aumentem a biodiversidade, a regeneração do solo e da água.					
Que o **Estado pague subsídios** aos agricultores na adoção de práticas agrícolas que aumentem a biodiversidade, a regeneração do solo e da água.					
Que **o Estado invista em campanhas de sensibilização** sobre a importância para a saúde e para o ambiente das práticas agrícolas que aumentem a biodiversidade, a regeneração do solo e da água.					
Outro:					

ESCALA DE FELICIDADE SUBJETIVA (LYUBOMIRSKY E LEPPER, 1999)							
Em geral, acho que sou	① Não muito feliz	②	③	④	⑤	⑥	⑦ Muito Feliz
Em comparação com a maioria das pessoas da minha idade, acho que sou	① Menos feliz	②	③	④	⑤	⑥	⑦ Mais feliz
Algumas pessoas geralmente são muito felizes. Elas aproveitam ao máximo a vida apesar do que se passa à volta delas. Acha que é como estas pessoas?	① De modo nenhum	②	③	④	⑤	⑥	⑦ Em grande parte
Algumas pessoas geralmente são pouco felizes. Elas nunca parecem tão felizes quanto poderiam ser. Achas que é como estas pessoas?	① De modo nenhum	②	③	④	⑤	⑥	⑦ Em grande parte

MATRIZ DE INDICADORES

5 NIVEIS MUDANÇA SIST.ALIMENTAR	10 ELEMENTO AGROECOLOGIA	DESEMPENHO AGROECOLÓGICO EXPLORAÇÃO	INDICADOR	0	1	2	3	4
NIVEL 1: Aumentar a eficiência das práticas agrícolas	RECICLAGEM	Agroecossistema | 4. Regeneração do ciclo da água	Poupança de água					
		Agroecossistema | 7. Fatores de produção	Produção e renovação de energia					
	EFICIENCIA	Agroecossistema | 5. Gestão de pragas, doenças e infestantes	Gestão de pragas e doenças					
		Agroecossistema | 3. Regeneração do solo	Gestão da fertilidade do solo					
		Agroecossistema | 1. Produção vegetal	Gestão de sementes					
		Agroecossistema | 2. Produção animal	Gestão espécies/ raças de animais					
NIVEL 2: Substituir inputs (fatores de produção) por alternativas mais sustentáveis	RECICLAGEM	Agroecossistema | 7. Sinergias económicas	Uso de inputs externos					
		Agroecossistema | 7. Sinergias económicas	Reciclagem de biomassa e nutrientes					
		Agroecossistema | 7. Sinergias económicas	Reciclagem de outros materiais que não biomassa					
NIVEL 3: Redesenhar os agroecossistemas	SINERGIAS	Agroecossistema | 3. Regeneração do solo	Sistema de gestão do solo-plantas					
		Agroecossistema | 6. Sinergias ecológicas	Integração com árvores (agroflorestal, silvopastoril, agrosilvopastoril)					
		Agroecossistema | 6. Sinergias ecológicas	Integração: culturas/animais					
		Agroecossistema | 6. Sinergias ecológicas	Conectividade entre elementos do agroecossistema e a paisagem					
	VAL SOC HUM	Agroecossistema | 2. Produção animal	Bem-estar animal					
	DIVERSIDADE	Agroecossistema | 6. Sinergias ecológicas	Biodiversidade					
		Agroecossistema | 7. Sinergias económicas	Diversidade de atividades de produção e serviços					
	RESILENCIA	Agroecossistema | 7. Sinergias económicas	Estabilidade do rendimento/produção e capacidade de recuperação de perturbações/ resiliência ambiental e capacidade de adaptação às alterações climáticas					
	EFICIENCIA	Agroecossistema | 7. Sinergias económicas	Registo da produção e pragas, doenças e infestantes					
		Agroecossistema | 8. Sinergias sociais	Produção e necessidades da casa/ alimentação adequada e consciência nutricional					
	VALORES SOCIAIS E HUMANOS	Agroecossistema | 8. Sinergias sociais	Dignificação dos agricultores/ condições de trabalho					
		Agroecossistema | 8. Sinergias sociais	Empoderamento feminino					
		Agroecossistema | 8. Sinergias sociais	Empoderamento de jovens e emigração					
NIVEL 4 Restabelecer as relações entre os agricultores e consumidores, desenvolvendo redes alternativas de alimentação	CUL E TRAD ALIMENTAR	Sistema Alimentar Local/Global | 10. Partilha de conhecimento agroecológico	Identidade e consciência local ou tradicional (agrícola) : inclui conhecimento tradicional para a preparação de alimentos (uso de variedades/raças locais)					
	CO-CRIAÇÃO E PARTILHA DE CONHECIMENTO	Sistema Alimentar Local/Global | 10. Partilha de conhecimento agroecológico	Acesso ao conhecimento agroecológico (pe plataformas para a criação horizontal de conhecimento e boas práticas) e interesse dos produtores pela agroecologia.					
		Sistema Alimentar Local/Global | 10. Partilha de conhecimento agroecológico	Relações com a comunidade					
	ECONOMIA SOCIAL E SOLIDÁRIA	Sistema Alimentar Local/Global | 9. Interações com o SAL	Redes de produtores, rel. com consumidores e presença de intermediários					
NIVEL 5 Reconstruir o Sistema Alimentar Local de forma que seja sustentável	GOVERNANÇA SUSTENTÁVEL	Sistema Alimentar Local/Global | 9. Interações com o SAL	Empoderamento dos produtores/ Mecanismos para reduzir vulnerabilidades/ Participação dos produtores na governança da terra e dos recursos naturais					

ANNEX 3 | Focus group guide – Article 4

GUIÃO | GRUPO FOCAL

Título da tese: Agroecology as a tool towards sustainable food systems transition
Objetivo da Sessão: Identificar - a partir do conhecimento coletivo- linhas orientadoras/ recomendações para propostas políticas de apoio à transição agroecológica em Portugal.

Duração: Até 3h
Número de Participantes: Até 15
Facilitador/a: 1 pessoa com experiência que não faça parte da equipa nem do movimento agroecológico
Observador/a: 2 membros da equipa de investigação
Registo: Gravação em áudio (com consentimento), notas dos observadores

Bloco	Objetivo	Descrição	Duração	Material
Acolhimento, consentimento e quebra-gelo	Criar um ambiente de confiança e compreensão comum.	FACILITADORA: Agradece a presença, explica as regras (gravação, consentimento, liberdade de saída, escuta ativa, respeito). Recolha do consentimento informado. INVESTIGADORA: apresenta-se, explica brevemente o trabalho de investigação, o que é agroecologia e o seu papel no sistema alimentar (transição agroecológica) FACILITADORA: quebra-gelo com cartas – cada pessoa escolhe duas cartas, uma sobre si e outra sobre a sua relação com o sistema alimentar e depois há uma partilha entre todos/as para que o grupo se conheça	30 minutos	Consentimentos informados (10 copias), canetas (10) Computador, projetor, cabo ligação HDMI, Apresentação sobre trabalho PhD e agroecologia/sistema alimentar
Identificação de prioridades	Compreender áreas-chave de intervenção política.	FACILITADORA: Em que partes do sistema alimentar acham que é mais urgente agir para apoiar a transição agroecológica? Incentivar a discussão entre 2-3 pessoas antes da partilha em plenário. Sistema alimentar disponível em A1 afixado numa parede.	20 minutos	Computador, projetor, cabo ligação HDMI, deixar a pergunta projetada e um A2 com esquema sobre sistema alimentar
Propostas de políticas públicas (recomendações)	Gerar linhas orientadoras e recomendações concretas.	FACILITADORA: Se tivessem de escrever 2 ou 3 recomendações prioritárias - para a transição agroecológica dos sistemas alimentares - para entregar diretamente ao Parlamento Português quais seriam? *As recomendações são linhas orientadoras estratégicas e de nível político, que expressam o que deve ser feito e porquê. Traduzem prioridades, princípios e objetivos: não descrevem como fazer, mas indicam a direção da política pública*. Pedir para escreverem as recomendações em post-its e que os coloquem no esquema do sistema alimentar junto da dimensão/oes mais abrangida pela recomendação	20 minutos	Computador, projetor, cabo ligação HDMI, deixar a pergunta projetada e um A2 com esquema sobre sistema alimentar, post its amarelos (por exemplo)
Concretização das medidas	Identificar instrumentos políticos e operacionais específicos	FACILITADORA: Agora que temos as recomendações, que instrumentos concretos - *incentivos, formação, certificação, mercados locais, compras públicas, redes de apoio* - poderiam torná-las realidade? Pedir para escreverem as medidas ou instrumentos políticos em post-its e que os coloquem no esquema do sistema alimentar junto da(s) dimensão/oes mais abrangidas	20 minutos	Computador, projetor, cabo ligação HDMI, deixar a pergunta projetada e um A2 com esquema sobre sistema alimentar post its azuis (por exemplo)
Alinhamento e priorização	Sistematizar e priorizar recomendações	FACILITADORA: Pede que observem o esquema completo e discutam brevemente se há recomendações que se reforçam mutuamente ou entram em tensão e partilhar com o grupo. Depois disso, cada pessoa vota nas duas recomendações mais importantes para a transição agroecológica do sistema alimentar	10 minutos	Computador, projetor, cabo ligação HDMI, deixar a pergunta projetada e um A2 com esquema sobre sistema alimentar Bolinhas autocolantes
Encerramento e próximos passos	Fecho do grupo focal	Agradecer, explicar que as recomendações e medidas serão sistematizadas e partilhadas com todos/as.	5 minutos	Bolo, fruta e chás e café para partilhar entre todas/os