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FORESIGHT FOR THE TRANSFORMATION OF AGRIFOOD SYSTEMS THROUGH AGROECOLOGY

Guidance document for decision makers and practitioners

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Abbreviations

AE TPP	Transformative Partnership Platform on Agroecology
AFD	Agence française de développement, France (France's development agency)
ANR	Agence nationale de la recherche, France (French national research agency)
BOKU	Universität für Bodenkultur, Austria (University of Natural Resources and Life Sciences)
CGAAER	Conseil général de l'alimentation, de l'agriculture et des espaces ruraux, France (High Council for Food, Agriculture and Rural Areas)
CIRAD	Centre de coopération internationale en recherche agronomique pour le développement, France (French Agricultural Research Centre for International Development
CIRDES	Centre International de recherche-développement sur l'élevage en zone subhumide (International Center for Research and Development on Livestock in sub-humid zones)
CIRED	Centre international de recherche sur l'environnement et le développement, France (International Research Centre on Environment and Development)
CLI	crop–livestock integration
DG AGRI	Directorate-General for Agriculture and Rural Development, European Commission
DyTAES	Dynamique pour une Transition Agroécologique au Sénégal (Dynamics for Agroecological Transition in Senegal)
EC	European Commission
ENISA	European Agency for Cybersecurity
ETC-Group	Action Group on Erosion, Technology and Concentration
FAO	Food and Agriculture Organization of the United Nations
FOFA	the future of food and agriculture
FTP	Forward Thinking Platform
GHG	greenhouse gas
GISAMAC	Group on Health, Food, Environment and Competitiveness
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH
HLPE	High Level Panel of Experts
IDDRI	Institut du développement durable et des relations internationales, France (Institute for Sustainable Development and International Relations)
IDR	Institut de Développement Rural, Burkina Faso (Institute for Rural Development)
INRA	Institut National de la Recherche Agronomique, France (National Institute for Agricultural Research)
INRAE	Institut National de la Recherche pour l'Agriculture, l'Alimentation et l'Environnement Agronomique, France (National Research Institute for Agriculture, Food and Environment)
INRAT	Institut National de la Recherche Agronomique de Tunisie, Tunisie (National Institute of Agronomic Research of Tunisia)
INERA	Institut de l'Environment et de Recherches Agricoles, Burkina Faso (Institute of Environment and Agricultural Research)

INTA	Instituto Nacional de Tecnología Agropecuaria, Argentina (National Institute of Agricultural Technology)
IPBES	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
iSDG	Name of a model developed by the Millennium Institute
ISRA	Institut Sénégalais de Recherches Agricole, Senegal (Senegal Agricultural Research Institute)
JRC	Joint Research Centre, European Commission
NGO	non-governmental organization
MAPRH	Ministère de l'Agriculture, des Ressources hydrauliques et de la Pêche, Tunisie (Ministry of Agriculture, Water and Fisheries)
MEAE	Ministère de l'Europe et des Affaires étrangères, France (Ministry for Europe and Foreign Affairs)
PP-AL	Politiques publiques et développement rural en Amérique latine (Public Policy and Rural Development in Latin America)
R&D	research and development
RySS	Regional Youth Support Services
SDGs	Sustainable Development Goals
SOLm	Sustainability and Organic Livestock model, developed by UNISECO
SSP-UK	Shared Socioeconomic Pathways – United Kingdom
SUSFANS	Metrics, Models and Foresight for European SUStainable Food And Nutrition Security, a European Union H2020 project
TYFA	Ten Years For Agroecology
UMR ART Dev	Joint Research Unit, Actors, Resources and Territories in Development, France
UNISECO	Understanding and improving the sustainability of agroecological farming systems in the EU, a European Union H2020 project
WEF	World Economic Forum
WRI	World Resources Institute

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Any errors or inconsistencies in this report are the responsibility of the authors.

Summary

In order to improve the contribution of foresight approaches to the transformation of sustainable food systems through agroecology, the Food and Agriculture Organization of the United Nations (FAO), the French Agricultural Research Centre for International Development (CIRAD) and the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH launched a global project in December 2022: *Foresight on challenges and opportunities for sustainable food systems and agro-ecological transition*. One of the outputs of this project is this guidance document on foresight processes for the transformation of food systems through agroecology, which explores the realms of agroecological foresight.

A systematic examination and rigorous analysis was made of 16 foresight processes, this body of work being hereafter named the corpus. This guidance document provides a comprehensive investigation of the existing intricate interplay among foresight methodologies, agroecological principles, and the dynamics of food system transformation. Thus, the guidance document contributes to scientific discourse by providing a novel framework for the integration of agroecology into foresight processes, thereby facilitating a scientifically rigorous and empirically grounded approach for the development of sustainable food systems.

The document provides insights and recommendations on how agricultural foresight processes can be used to properly consider integrated and biodiverse approaches, such as agroecology. The goal is to expand the range of choices and routes available to decision-makers and societies when envisioning pathways to transformative food systems.

The preliminary findings of the stocktaking analysis were presented and discussed during a Global Workshop: *Exploring agroecological futures: method, purposes and implications* held at FAO headquarters in November 2022. The main lessons learned during the workshop were communicated and discussed with a broader audience during a webinar. All workshop participants had the opportunity to comment on the draft version of the report, and another webinar took place in December 2023 to finalize the report and discuss its dissemination.

This guidance document synthesizes stocktaking analysis, workshop discussions and perspectives in the literature to serve two main audiences. It is designed to help foresight practitioners implement foresight differently and better integrate agroecology that supports transformation towards sustainable food systems. The document can also help agroecology researchers better understand what foresight is, and why such a process is useful in supporting sustainable food system transformation through agroecology. For both groups, the document provides an overview of the key findings of the foresight processes studied.

Four concepts are employed:

- **Foresight** is a systematic, participatory and multidisciplinary approach to exploring mid to long-term futures and drivers of change. Foresight relates to the systemic thinking that can lead to change. Foresight integrates breakdowns and ruptures and involves three attitudes that are constantly linked: anticipation, appropriation and action.

- **Food or agrifood systems** comprise the range of actors and their interlinked activities from the production to the disposal of products originating from agriculture (crops and livestock), forestry, fisheries and food industries, along with their broader economic, societal and physical environments. The representation of agrifood systems is from the report: *The future of food and agriculture – Drivers and triggers for transformation* (FAO, 2022).

- The **transformation of food systems** involves profound changes in norms, behaviours and practices in what is produced and how it is produced, processed, stored, transported, and consumed.

- **Agroecology** is a holistic and integrated approach that simultaneously applies ecological and social concepts and principles to the design and management of sustainable agriculture and food systems. Agroecology seeks to optimize the interactions between plants, animals, humans and the environment while taking into consideration the social and political aspects that need to be addressed for a sustainable and fair food system. References are made to the five different levels of agroecological transitions, which were identified by Gliessman (2016) and to the High Level Panel of Experts (HLPE) on Food Security and Nutrition's thirteen principles (HLPE, 2019).

Key findings and recommendations are provided for each of the seven phases of the foresight process: identifying the designer of, and participants in, the process and defining its scope; building the system; identifying drivers and formulating assumptions; building scenarios and models; drawing lessons from scenarios; proposing options for action; communicating and debating the results. Here are the key findings of this research:

- The transformation of food systems through agroecology is a political question with financial implications. There are potentially important benefits for human and animal health and the environment, but some institutions tend to block, slow down or prevent transformation to agroecology. Foresight comprises an innovative *agora* or open space to engage in structured debates among the actors of the food system. This provides for the possibility of opening up possible futures to contribute to their "manufacture" (Treyer, 2022), and the formation of strategic thinking to support action. The future of agroecology depends on the capacity of diverse worlds to create common ground and foster trust through social imaginaries (Castoriadis, 1987; Taylor, 2004), knowledge, networks and collective action.

- The works analysed in this document present a variety of foresight methodologies, from quantitative modelling to qualitative writing of narratives. A variety of concepts are considered concerning agroecology, which embraces the entire food system. This food system approach facilitates the highlighting of more levers of change and blockages to systems than are often considered. It also ensures better understanding of the power and ability of each actor to change the food system. In addition, the scenarios also demonstrate that, even within the same concept of agroecology, it is possible to have several transformations of food systems, which can be situated on an agroecological spectrum.

- The corpus shows that over the past 12 years a variety of foresight processes have involved agroecology, even if there are not so many. Therefore, more linkages could be established between the foresight and agroecology epistemic communities to develop foresight activities involving agroecology. It appears that an avenue for research on methodological improvements exists. Better articulation should be considered between quantitative and qualitative approaches, which would lead to improved alignment between the aims and methodologies, as well as a step back from their strengths and weaknesses. There are also blind spots in questions tackled and drivers considered. Participation and co-creation of knowledge, which are key principles of agroecology, could be reinforced. Therefore, it is recommended that additional foresight processes, on the future of food systems involving agroecology, are commissioned and funded, and especially coming from institutions in the Global South. Effective foresight requires freedom of thinking and action, follow-up and continuous deliberation and experimentation to build trust and credibility, which is a long-term process.

- Participatory approaches have been employed, but in only a few cases have participants in all core activities and levels of the food system been involved. Effective uptake of foresight in decision-making and policymaking requires the involvement of all types of stakeholders, i.e. farmers and other holders of local knowledge; grassroots movements; representatives of the core activities of food systems (i.e. processing, retailing, transport, storing, disposing sectors and supporting services); consumers; policymakers; non-governmental organizations (NGOs) and associations; and researchers in agroecology. This will help create a common language among the diverse actors, will facilitate enlargement of perspectives on agroecology and prevent the development of blind spots. Policymakers and other major decision-makers should be involved at the start of the foresight process, as responsible governance is a key element of agroecology. Paying attention to the ethics of participation and deliberation is also crucial. This is why sufficient resources, skills and time should be allocated to the facilitation of such processes.

- When the time dimension and the concept of ruptures are appropriated within foresight processes, reactions to unplanned circumstances should be more rapid. It is also important to consider how radical social and societal change may be. This includes the speed of development – slow or rapid – and how quickly technical and organizational innovations are adopted, including those in agroecology, in the past and in the future.

- All the foresight studies adopted systemic thinking. The system designed in each study in the corpus varies, depending on the targeted questions, the approach (qualitative or quantitative), the geographical scale, etc. The main differences are the level of detail and the mode of visualization of the respective systems. In all cases, the systems approach makes it possible to overcome disciplinary specialization, simple relations between inputs and outputs and linear schemes. Explicitly showing the structure of the system allows us to focus on interactions between the causes of changes and emerging properties, and to show the location of gaps and blind spots. This approach is well suited to envisioning the future of agroecology, as it embraces its key principles (such as synergy and complementarity between the elements of agroecosystems, circularity, solidarity, and connectivity). It also enables the development of a cross-sectoral vision of agroecology, and assists us to better explore the articulation between geographical scales.

- The choice of drivers should be a collaborative process: it should be transparent and take into account the range of subjective experiences. The categories of drivers that are most used are related to production systems (crops and livestock, the use of inputs); food diets and non-food uses; demography; geopolitical context, economic organization and trade; land use and associated conflicts; energy resources and uses. There are, however, blind spots in the drivers, for example forestry systems and fisheries; science, innovation and the co-creation of knowledge; waste and losses; organization of the supply chain (processing, storage, distribution, logistics, transport, recycling); actors' values; food prices; economic viability and the farm's capital structure; how the financial system functions; capital flows; access to water and its uses; epidemics and ecosystem degradation; the control of big data. All agroecology principles should be considered when selecting food system drivers so as to formulate assumptions. It is also important to work in a transdisciplinary manner, with different actors, as this will help broaden the agroecology spectrum. Assumptions should be based on the principles of agroecology and it should be recognized that all drivers and assumptions are not commensurable, even when there are proxies.

- Five foresight processes include more than one scenario with agroecological approaches demonstrating that agroecology is not monolithic and that several pathways are possible. When there are two contrasting scenarios (usually business as usual versus agroecology), the communication of key messages is clearer but the situations described are stereotypical. Multiple scenarios can be built around two axes with the matrix methodology or can result from the coherent combination of assumptions using a morphological analysis. It is recommended that the future of food systems be enlarged through agroecology by developing several scenarios that contain agroecological principles and that powerful and imaginative representations of the future are created. Narratives should be appealing, engage the emotions and be concrete. The combination of qualitative and quantitative methods will help in the understanding of changes and in being more convincing than only stories or numbers.

- Four types of models are used in the foresight processes: biophysical balance, economic, system dynamics and spatial models. Introducing agroecology in foresight processes requires more context-specific data to evaluate the orders of magnitude of future changes. The question of yields is central, and there is no clear consensus. New metrics and better-quality data are necessary to form assumptions about agroecology. This could be achieved through increased connections between research communities, improved open access and additional research funds. Furthermore, new models are necessary for agroecology that integrate updated and suitable development in different disciplines (for example, sustainable supply chain management, post-Keynesian economics, etc.).

- All the foresight processes reviewed shed light on the fact that the future with "conventional", "input-intensive", or "industrial" food systems is not desirable. In the scenarios that focus on agroecology, diverse transformations in food systems take place that feed positive synergies such as healthier diets; improved attainment of the Sustainable Development Goals (SDGs); increased biodiversity; better farm employment and revenues; carbon sequestration.

- The scenarios involving agroecology show there is no universal solution to the transformation of food systems. Agroecology does not solve all problems, and can also lead to trade-offs, with possible social and political tensions. This is why the existence of a public space with diverse participation is required. This arena would represent an opportunity to seek common ground and expose the roots of incompatibilities so as to go beyond polarization. Foresight offers tools that have been adapted for doing so, as different actors are gathered to discuss the variables that are key to the functioning of the food system, to learn from each other, and to outline the different possibilities for the future, a temporal "space" that is beyond current interests and conflicts.

- Most options for action relate to agricultural and nutritional practices and policies, the use of inputs, social rights, financial support and trade regulations. Other important topics are education and training, land tenure, transportation, supply chain management, science and innovation, and the coordination of policies. Policies must be adapted to each territory or country but there are *no-regret* objectives that should be pursued, whatever the scenario, to avoid catastrophic consequences. Decision-makers should therefore better integrate the culture of anticipation.

- All foresight processes led to a group dynamic forming among the implementers and participants, where there was individual and collective learning. One indicator that the process was successful is that the participants appropriated the results.

- The implementers may have various modes of communicating the foresight processes. All have published books, articles, and reports and have made many presentations of their results. Some have websites that set out their results and ongoing activities. Preparing a communication strategy, and diversifying the communication channels, including the new media, is important for targeting the various political arenas. All the foresight processes in the corpus aim to nurture debates on agroecology and create new social imaginaries.

1. Introduction

1.1 CONTEXT AND OBJECTIVE OF THIS REPORT

Anticipating how our food systems – local, regional and global – can transform is central to building coordinated actions adapted to the Anthropocene – the possible name for the current geological era characterized by significant human impact on the functioning of the Earth. Agroecology is a key part of this response. Foresight approaches, for their part, can contribute to sustainable food systems because they create new political arenas. They facilitate debates among and across various networks, and open up new options to social actors, from grassroots movements to policymakers. But how well adapted are current foresight practices to agroecology? And how can they be improved?

The Food and Agriculture Organization of the United Nations (FAO) considers that foresight is a useful process that provides "*a better understanding of the various emerging drivers and trends and their related opportunities and challenges, under the evolving global context*" (FAO. 2022c). Three issues of The Future of Food and Agriculture were published (FAO, 2017, 2018a, 2022a) and Thinking about the future of food safety (FAO, 2022b), look at global trends and alternative future scenarios to analyse possible pathways for food and agricultural systems. Over the last six years, a number of foresight processes, relative to the future of food systems, have also been implemented by different agricultural research institutes, development institutions and think thanks. They include:

- Nutrition and food systems. A report by the High-Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security (HLPE, 2017).
- Shaping the Future of Global Food Systems: A Scenarios Analysis (World Economic Forum [WEF], 2017).
- Agrimonde-Terra: Land Use and Food Security in 2050 (Le Mouël, de Lattre-Gasquet and Mora, 2018).
- Resilience and Transformation – Report of the fifth SCAR foresight exercise expert group (European Commission, 2020).
- Creating a sustainable food future. A menu of solutions to feed nearly 10 billion people by 2050 (World Resource Institute [WRI], 2018).
- Metrics, models and foresight for European sustainable food and nutrition security: The vision of the Strengthening European Food And Nutrition Security (SUSFANS) project (Rutten *et al.*, 2018).
- Feeding ten billion people is possible within four terrestrial planetary boundaries (Gerten *et al.*, 2020).
- *Future Food Systems: For People, Our Planet, and Prosperity* (Global Panel on Agriculture and Food Systems for Nutrition, 2020).

In most scenarios the future seems bleak, except when there is a transformation towards sustainable food systems with notably different diets and modes of production. In many of the reports cited above, **agroecology is considered to be one of the transformation pathways**. Support for agroecology was confirmed during the United Nations Food Systems Summit, during which an Agroecology Coalition for the transformation of food systems was created.

How have past foresight processes contributed to this transformation and how could they contribute even better and more? As agroecology calls for radical transformation, future-oriented thinking appears consubstantial. To rephrase de Jouvenel (2004), futures are a realm of freedom (for creativity), of power (for particular interest groups) and of will (for change). Foresight processes can therefore explore, support or advocate for the development of agroecology, and identify the forces that contribute or hinder its development and changes. It can also help identify pathways for transformation and changes in policies, practices, techniques and social contexts, as well as potential resistance and opposition, risks and advantages.

This report, and a workshop and webinar which took place in November 2022, are key components of the **global project: *Foresight on challenges and opportunities for sustainable food systems and agroecological transition*** (GCP/GLO/1039/GER-F) implemented by FAO in collaboration with the French Agricultural Research Centre for International Development (CIRAD) and with support from the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH.

The aim of this report is to provide guidance to foresight practitioners and donors on the use of foresight processes for sustainable transformation of food systems through agroecology. Drawing lessons on the use of foresight tools, to support policies and practices for this agroecological transformation, required the analysis of past foresight exercises as accomplished by several authors in the literature. Van Dijk and Meijerink (2014) and Le Mouël and Forslund (2017) compared 12 and 25 scenarios respectively that focus on food security. Lacroix *et al.* (2019) analysed 307 scenarios that deal with the environment in general. The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES, 2016) looked at 12 scenarios to provide a methodological assessment report on scenarios and models of biodiversity and ecosystem services. Couturier, Aubert and Duru (2021) proposed an analysis of 16 scenarios on the land sector with the quantitative goal of carbon neutrality, whereas Muiderman *et al.* (2020) classified 19 food projects depending on their vision of anticipatory governance.

Our approach comprised four steps: creation of a corpus of 16 foresight studies (including 13 main exercises and three subexercises) related to the transformation of food systems through agroecology carried out over the last 12 years; analysis and comparison of foresight activities using a common framework based on the review of the literature; discussion of analysis and lessons drawn during a participatory workshop that took place in Rome in November 2022, which was co-organized by FAO, CIRAD and GIZ; communication and discussion of the main results took place during several seminars.

Comparing foresight processes to transform food systems through agroecology intertwines two levels of complexity. A first level comprises all the controversies concerning the definitions of food systems and agroecology, as well as their use in debates on agricultural transformation. The second level assembles the diversity of foresight perspectives, opinions and approaches to tackle the multiple challenges of transitions. These contrasting perspectives lead to a variety of methods and practices (quantitative, qualitative or mixed methods; level and nature of the participation process; disciplinary and transdisciplinary focus), which are also shaped by the available resources: financial, human and time. This diversity of futures echoes the continuum of agroecology representations.

This report is organized as follows. First, the different key concepts of the study are discussed. Then, the four steps of the methodology used for the analysis are detailed. In particular, the construction of an analytical grid, used to describe each foresight exercise, is presented; we call these documents "*fiche*" (i.e. note card). Afterwards, we look at the seven steps in the construction of a foresight process so as to present the analysis of the different studies and to draw up specific recommendations. Finally, the main conclusions are presented.

1.2 TARGETED AUDIENCE AND USE OF THIS REPORT

This guidance document caters to a diverse readership, but focuses on two primary audiences. The first group comprises **foresight practitioners** – individuals engaged in the strategic analysis of future scenarios and trends within the realm of the transformation of food systems towards sustainability. For foresight practitioners, this report aims to answer a crucial question: **"How do we engage in foresight differently so as to better integrate agroecology in the support of transformation towards sustainable food systems?"** To tackle this question, the document includes an analysis of foresight methodologies that dissect how different aspects, or steps, of these methodologies could be approached differently to embrace agroecology as a catalyst for sustainable transformation of food systems.

Invaluable insights are shared along with general recommendations and a foundational framework to enhance integration of agroecological approaches in foresight exercises. By providing practical guidance, and highlighting the significance of agroecology within agricultural foresight, this book equips practitioners with the tools required to navigate the complexities of food system transformation while aligning with sustainable and biodiverse practices. The guidance document also encourages practitioners to explore innovative ways to conduct foresight to promote agroecological principles, thus fostering a shift towards more sustainable food systems.

The second pivotal audience for this guidance document comprises **agroecology practitioners**, who play a vital role in advocating and implementing sustainable and biodiverse practices. For them, this report investigates the questions: **"What is foresight, what insights does the foresight process provide for agroecology, and why is it important to support the transformation of sustainable food systems through agroecology?"** By delving into this question, the report provides insights into the strategic use of foresight to leverage the potential of agroecology and advance the cause of sustainable food systems on a global scale. The document provides agroecology practitioners with methodological insights into how foresight can be effectively incorporated into their work. Various methods are outlined that are commonly used during foresight exercises. The document discusses the way they can be applied to assess the potential impacts of agroecological practices over different timeframes and scales. In response to the need for global and harmonized evidence, this document proposes foresight as a practical strategy for agroecology practitioners to collect, compile, and analyse data from diverse sources, allowing them to build a robust evidence base for advocacy and policy engagement. Recognizing the importance of influencing policy decisions, the document outlines how foresight can be employed to anticipate the potential impacts of policy changes on agroecological practices and how foresight can guide the crafting of evidence-based policy recommendations.

2. Concepts and their definition

The concepts employed in this guidance document are presented in the following order: foresight; food systems; transformation and agroecology. We conclude with a synthesis of the various frameworks found in the literature on agroecology and food systems.

2.1 FORESIGHT

Foresight is "a systematic, participatory and multidisciplinary approach to explore mid to long-term futures and drivers of change" (Forward Thinking Platform [FTP], 2014), that is meant to lead to change. Foresight relates to systemic thinking. This concept integrates breakdowns and ruptures and is, therefore, different from forecasting, which is only based on past trends.

The central concept of a system system embodies "a set of elements connected together which form a whole, thus showing properties which are properties of the whole, rather than properties of its component parts" (Checkland, 1981). System analysis not only considers the structure of the connections between the different components, but also how this structure evolves dynamically, through flows and feedbacks. It allows us to "see the forest through the trees", i.e. to identify, observe, analyse and shape systems, as well as the relationship dynamics between its elements (European Agency for Cybersecurity [ENISA], 2021). The complexity of questions facing agriculture has led to wide adoption of the systems approach in this sector, and the commonly used expressions include food systems, farming systems and cropping systems. The systems approach makes it possible to overcome disciplinary specialization, simple relationships between inputs and outputs, linear schemes and interactions between spatial scales.

Foresight involves **three constantly linked attitudes and processes** (Godet, 2006):

- **Anticipation** is thinking about the medium and long-term, about possible and desirable futures to clarify present actions.
- **Appropriation** is debating in order to perceive futures collectively, to prepare oneself for foreseeable change or to provoke desired changes.
- **Action** involves acting to influence, and avoid, undesirable changes or to materialize desired changes.

Only through anticipation and appropriation is it possible to arrive at action. Philosophical precepts behind foresight state that the future is a realm of freedom, a realm of power, and a realm of will (de Jouvenel, 2004). The future is often a source of preoccupation, and current rapid rates of change, breakdowns and, the impression of increased chaos and anxiety. However, the future is not predetermined and it is not the continuation of the past. On the contrary, there is an array of possible futures that can map a "possibility space" (Berkhout and Hertin, 2002), which can be shaped by human choice and action and that is constantly changing and, hence, must be monitored on a permanent basis.

The future can inform decisions in the present. All the actors have a certain amount of individual power that can enable them to act. When anticipating the future, it is important to consider the various actors present, and their power and influence on each other (Hebinck *et al.*, 2018). Moreover, as the philosopher Seneca once wrote in a letter to Lucilius: "There is no fair wind for one who knows not whither he is bound". This indicates the importance of having a goal, a set of ideas or values, and being able to conceive of a desirable future.

For anticipation, there are qualitative and quantitative methods that can be used separately or jointly. Qualitative methods represent the future in the form of narratives or visual symbols. Common methods and tools include scenario planning; envisioning; backcasting; causal layered analysis; the futures wheel; the futures triangle and the Delphi Method. Qualitative methods are often employed in a participatory way, which leads to appropriation. Quantitative methods for anticipation imply the use of models, i.e. integrating and generating numerical values to provide quantified representations of the future. Different types of models can be employed (see Section 4.4.1 for the models used in the corpus). Many foresight processes combine both qualitative and quantitative methods and data sources, even though methods are more complementary than integrative (Elsawah *et al.*, 2020a; Jahel *et al.*, 2023). Quantitative data measure a few elements in a system, while qualitative data provide insights into the processes of change.

Appropriation and action require participatory methods and the participation of stakeholders. Action, i.e. strategy and policymaking, implies engagement of stakeholders inside and outside the organization and co-created knowledge. This can be met by a foresight process that involves a participatory approach that facilitates dialogue among diverse stakeholders at various geographical scales and from different sectors. The variety of stakeholders may be limited. Participatory approaches provide researchers or experts more ideas to work with, and it is a powerful way to alleviate biases and the adherence to questions concerning simplistic metrics and ideologies. Appropriation leads to empowerment, i.e. developing the capability of local actors to pursue their own objectives and influence a given situation (Bourgeois *et al.*, 2017).

Scenarios are representations of possible futures that aim to clarify present action considering possible and desirable futures. When scenarios are built with qualitative methods, they are narrative descriptions of how the future may unfold according to an explicit, coherent, and internally consistent set of assumptions about key relationships and driving forces. Both the end-state described, as well as the causal logic explaining how this future came about, comprise a narrative. Scenarios can be created using a variety of methods. When they are built employing only modelling, they provide quantitative results on specific elements. Often scenarios have narrative as well as quantitative results that arise from modelling, and the two can be built in interaction. There are five conditions that promote their credibility and usefulness: pertinence, coherency, likelihood, importance, and transparency (Durance and Godet, 2010). Exploratory scenarios represent different plausible futures and integrate breakdowns and ruptures. Normative scenarios (or target-seeking scenarios) depict an agreed-upon and preferable future without transgressing the realm of the possible.

According to Godet (2004), **there are five attitudes to the future**: passivity, which is acting like an ostrich with its head in the sand waiting for change; reactivity is like a firefighter waiting for the fire to be declared before fighting it; preactivity, which is similar to an insurer who prepares for foreseeable changes because they know that repair is more expensive than prevention; proactivity is similar to a conspirator who acts to bring about the desired changes. The objectives of foresight processes are always **oriented towards transformative action. If there is no objective fact in the future, anticipation fosters a better understanding of the present so as to influence tomorrow**.

We have identified four types of aims that were employed to analyse our corpus. Inspiration has been taken from former comparative studies and analytical frameworks (Muiderman *et al.*, 2020; Couturier, Aubert and Duru, 2021; Bourgeois *et al.*, 2017; Minkkinen, Auffermann and Ahokas,2019).

- **Advocacy** for another future, i.e. choosing one positive future and mobilizing to achieve it.

- **Structuring debate**s and navigating diverse futures to mitigate or reduce future risks.
- **Shedding light on political implications** in the present of scenarios and supporting public decision-making.
- **Empowering**, developing capabilities for anticipation and action, co-creating new and transformative futures.

2.2. FOOD OR AGRIFOOD SYSTEMS

According to von Braun *et al.* (2021):

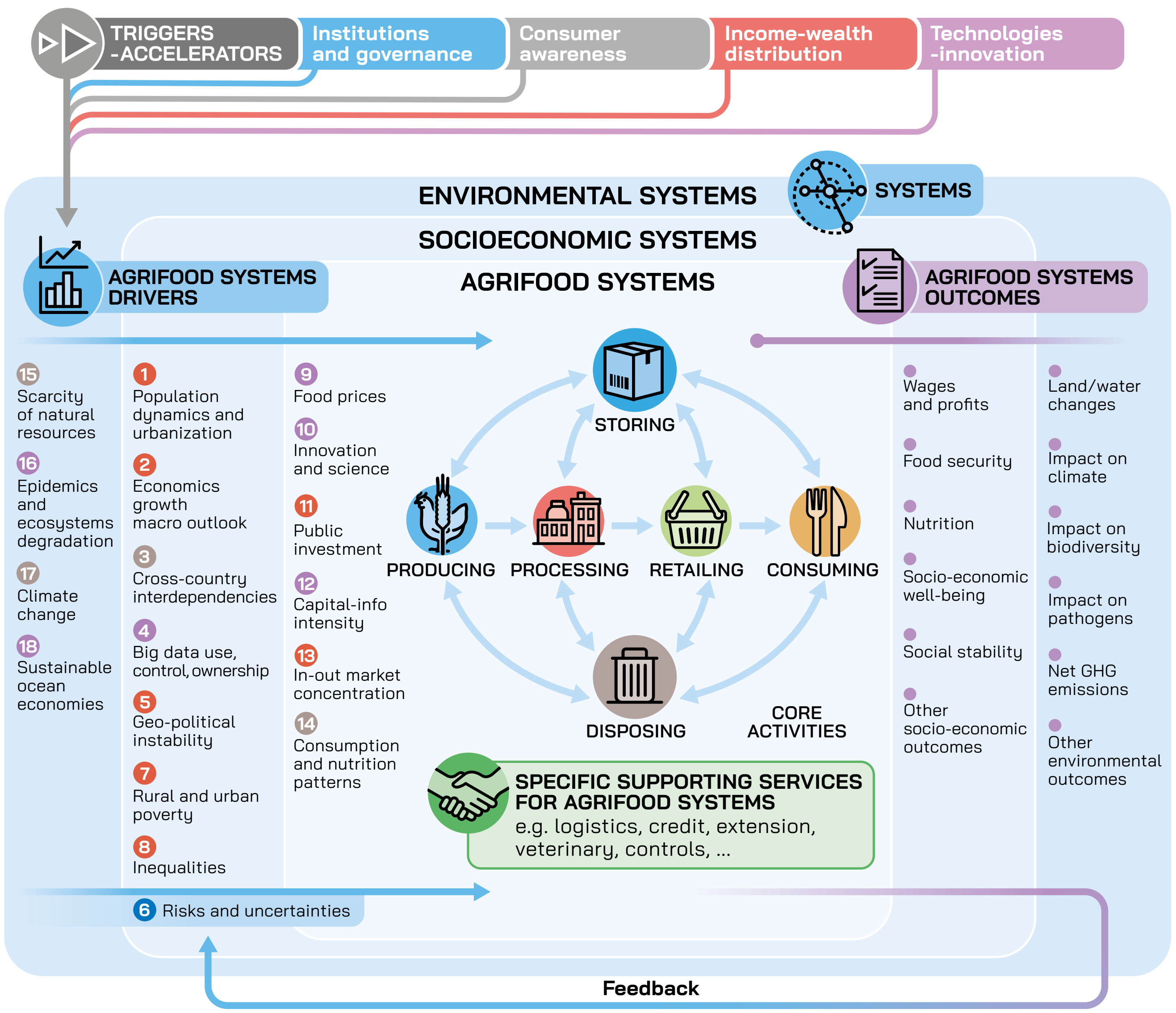
> *"… food systems embrace the entire range of actors and their interlinked value-adding activities involved in the production, aggregation, processing, distribution, consumption and disposal (loss or waste) of food products originating from agriculture (including livestock), forestry, fisheries and food industries, along with the broader economic, societal and physical environments in which these activities are embedded. The range of actors includes, importantly, those from science, technology, data and innovation sectors".*

This conceptualization requires fixing the boundaries of the system, its building blocks and the relationships between them. It also requires setting the linkages and interconnections with close systems such as the health and energy systems among others. **As systems, food systems are complex and dynamic.** Change happens through external and internal multifactorial drivers, and through feedback mechanisms between drivers. **These drivers stem from the interplay between the multiple sociotechnical, institutional, and political structures and the agency of actors at a microlevel.**

Note that we use the term "food systems" (plural) in this report, since we consider that several food systems coexist and interconnect (e.g. agro-industrial food system, agroecological food system, etc.), and that different scales entail different systems.

There are several representations of food systems. For example, FAO (2018b) developed a food system wheel with four large categories of drivers: natural elements, societal elements, the core system – which includes a layer of activities through which food products flow (production, aggregation, processing, distribution and consumption, including waste disposal) and a layer of services supporting the flow, as well as the behaviour of diverse actors. Other interesting representations include those by David-Benz et al. (2022) and the Foresight4Food initiative (Foresight4Food, n.d.). In 2022, FAO published the report *Future of food and agriculture. Drivers and triggers for transformation*, which includes a more detailed representation of what is now renamed agrifood systems (FAO, 2022a). This representation was used in this report (see **Figure 1**).

Figure 1. *Conceptualization of an agrifood system*



Source: FAO, 2022a. The future of food and agriculture – Drivers and triggers for transformation. The Future of food and agriculture, No. 3. Rome.

2.3. TRANSFORMATION AND TRANSITION

The multiplicity of crises leads scientists, among others, to call for systemic societal changes (Webb *et al.*, 2020). The diagnosis of the difficulties and threats seems to be consensual. However, there is no clear consensus on the nature of the desired changes, their drivers and how deep and radical these changes should be. The terms used to describe these changes vary: transition, transformation, transformation pathway, shift. These terms are often employed in seemingly interchangeable ways, which makes them sound like buzzwords. We will define these different concepts and look into their uses.

Initially, in Social Sciences, **transition** refers to the passage from one state of equilibrium to another, as in demographic or epidemiological transition.

Subsequently, this linear vision of change has been criticized, and transition has been used to denote a **change from one societal regime or dynamic equilibrium to another** (Beucher and Mare, 2020). Another use of the word "transition" comes from local citizen initiatives, as a response to inventing "post-carbon" lifestyles on a community scale, as in the Transition Towns movement (Hopkins, 2008). Transition has also been used by policymakers in France to designate the Ministry of Ecological transition. For its part, the High Level Panel of Experts (HLPE, 2019) defines the transition of food systems as "a change in a system, occurring over a period of time, in a specific location", which "includes **political, socio-cultural, economic, environmental and technological shifts in values, norms and rules, institutions and practices"**. This takes place because "the dominant economic, environmental, political and technological paradigm, rules, institutions and practices become increasingly incompatible with new expectations" (HLPE, 2019).

The process of **transformation** has been described variously by Keynesian, Schumpeterian and Polanyian scholars, as the intentional action of a subject on an object. It implies a change of mental modes, social practices and even the development of new values (McAlpine, 2015). It is characterized "by the destabilization of existing behaviours, social practices, infrastructures, technological systems, and business and administration models, while rebuilding new ones" (Duncan *et al.*, 2022).

In academia, the use of one or another concept mostly depends on the **epistemic community**. The sustainability transition community tends to use "transition" to describe **a fundamental change from one sociotechnical dominant regime to another** (Geels, 2011). The environmental governance community (Evans *et al.*, 2023) commonly employs the concept of "transformation" as **changes in socio-ecological interactions and feedback** (Hölscher *et al.*, 2018). Other scholars refer to **regime shifts** such as in the domain of political economy where a food regime (Friedman and McMichael, 1989) is a **configuration of geopolitical power** with stable capital accumulation. From the perspective of thinking about resilience, regime shifts occur when social-ecological systems have crossed a tipping point (Pereira *et al.*, 2020). More generally, a distinction is made between the transition or transformation process, which is the overall process of changing from a state A to B, and the **pathways**, which are the diversity of intermediary states that can be travelled through (Wigboldus, 2020).

Overall, transition or transformation is viewed as a way to respond to increasing challenges (Renouard *et al.*, 2020). Rising voices call for a **structural transformation** rather than **incremental**, be it **smooth and gradual or rapid and abrupt**. This transformation does not only refer to the technological environment, but also to a change of knowledge system, mindset, worldview, norms, values, practices, mode of organization and social interactions, among others, that evolve in a **complex and uncertain world** (Goulet *et al.*, 2022).

The diversity of behaviours that respond to the complexities and uncertainties of situations led Lamine *et al.* (2021) to question the very **vision of change** that the actors (including researchers) have when they talk or write about transitions. They define two ideal types of **"ontological relationship to change"** that "guide decisions on why, how and by whom" changes are implemented. On the one hand, a **deterministic perspective**, based on causality and the pre-definition of targets, rests on control-and-planning management styles (for example, in approaches to transition management).

On the other hand, **open-ended visions** of change acknowledge subjectivity and advocates redefining targets and pathways along the way (as in adaptive or reflexive management modes, or in social emancipation perspectives). These visions are often entangled in transition projects, which can be a source of synergies or tensions.

There is a strong relationship between this ontological distinction and the ontological dichotomy found in future studies. Some anticipation practices (Miller, 2018) distinguish two visions of the **"use-of-future": anticipation-for-the-future** and **anticipation-for-emergence**.

The first perspective considers probable or desirable futures for preparing or planning, while the second analyses emergent novelty in the present stating that the future is undeterminable. Together, these approaches aim at improved engagement "in spontaneity and improvisation" in the face of emerging complexity. Engaging in foresight is therefore key to the governance of transformations when the "manufacture of futures" is considered (Treyer, 2022). This social and political process leads to the selection of the possible narratives about the future and reveals power relationships.

In this report, transformation is approached from a normative perspective, as the futures of food systems are analysed through the lenses of sustainability. For the different studies in the corpus, we compare the openness of the futures, the extent, radical and systemic nature of the transformations, as well as the proposed levers for change.

2.4. AGROECOLOGY

The definition and implementation of **agroecology** is at the heart of many debates and still the object of controversies (Dumont *et al*., 2021). Its conception is diverse among actors, although its practice is substantially location-specific. The term agroecology can refer to a **pluri-disciplinary science, to practices and techniques and to a social movement** (Wezel *et al.*, 2009). As a science, its scope expanded from a focus on the plot through agronomic sciences to agroecosystems, territories and food systems as defined above. Consequently, it incorporated ecology, economics, sociology, anthropology and health and nutrition sciences among others. As a practice, it started with the recognition of indigenous agricultural knowledge and natural resource management, then the notion developed into an alternative paradigm to conventional modernity and agriculture. As a social movement, in the beginning agroecology supported traditional family farming, and is currently embedded in broader social struggles such as rights to food and food sovereignty. Today, agroecology is even the object of specific laws and policies. If a large number of actors recognize a direction is desirable (as demonstrated by the formation of an Agroecology Coalition),[1] it may still come into conflict with the unfavourable balance of power.

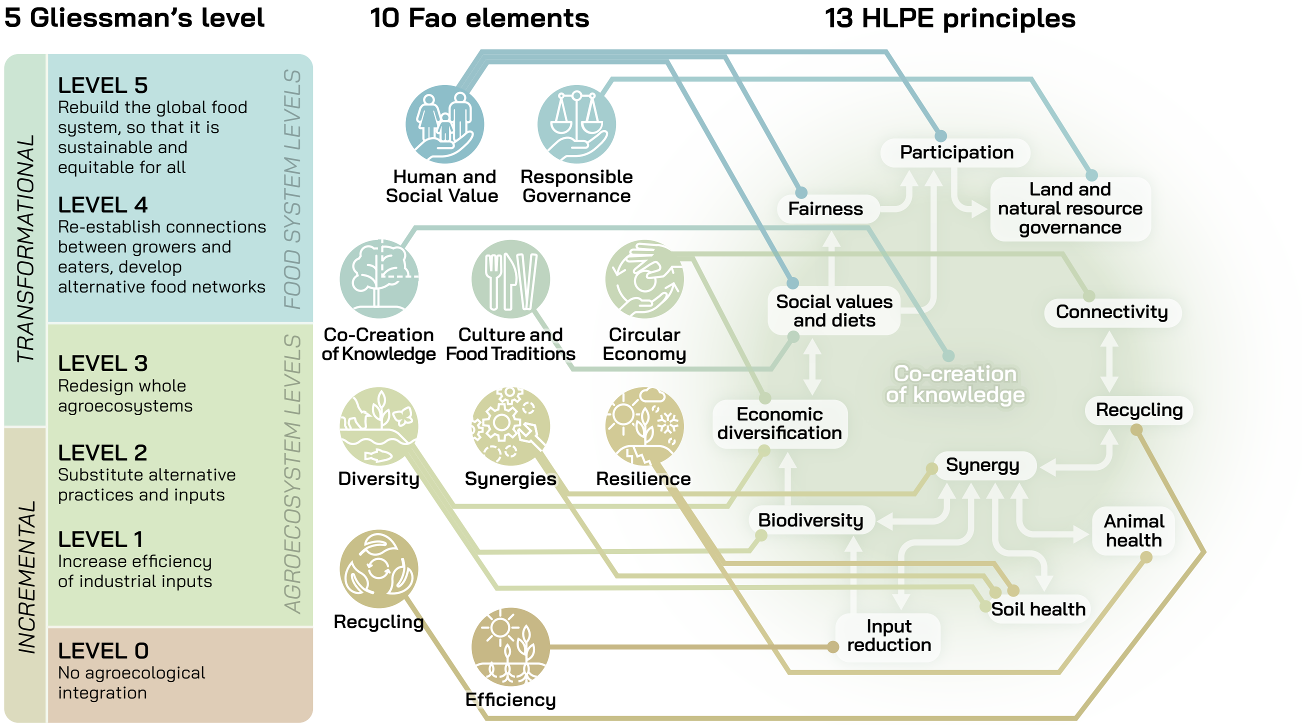
Diverse conceptual frameworks stem from this historical construction. The leading peasants' social movement ***La Via Campesina*****, places the concept of agroecology as one key aspect of sustainable peasant farming**. In this case, it is above all political, since it is embedded in power dynamics, social configurations and economic structures. In 2015, delegates from different organizations of small-scale producers and consumers gathered in **Nyéléni** (Mali) and "came to a common understanding of Agroecology as a key element in the **construction of Food Sovereignty**" (Declaration of the International Forum for Agroecology, Nyéléni, Mali, 2015). Agroecology is, therefore, conceptually rooted in peasants' struggles for land, autonomy and food sovereignty. The last ten years has marked the institutionalization of this concept.

In 2018, **FAO defined a set of ten constituent elements of agroecology** to structure and assist its implementation in Member Countries (FAO, 2018c). During the same period, the High-Level Panel of Experts on food security and nutrition conducted an extensive review of the concept that led to the **expression of 13 principles** (HLPE, 2019), corresponding to one or more FAO elements. The principles relate to: recycling; reducing the use of inputs; soil health; animal health and welfare; biodiversity; synergy (managing interactions); economic diversification; co-creation of knowledge (embracing local knowledge and global science); social values and diets; fairness; connectivity; land and natural resource governance; and participation. An agroecological approach to sustainable food systems is defined by the HLPE report as:

> *"one that favours the use of natural processes, limits the use of external inputs, promotes closed*

1 Agroecology Coalition. No date. *The coalition for food systems transformation through agroecology*. Rome. https://agroecology-coalition.org/

Figure 2
Agroecology: the five levels of Gliessman (2016) and the 13 High Level Panel of Experts' principles of the transformation of food systems via agroecology (2019)



•**Linking FAO's 10 elements, Gliessman's 5 levels of food system transformation and the 13 HLPE principles**
Correspondence based on Wezelet nl., 2020. Agroecological principles and elements and their implications for transitioning to sustainable food systems. A review. Agronomy for Sustainable Development, (2020) 40; 40.

Sources: Gliessman, S. 2016. *Transforming food systems with agroecology, Agroecology and Sustainable Food Systems*, Vol 40, No. 3, p. 187-189, mars 2016, and Atta-Krah, K., Chotte, J.-L., Gascuel, C., Gitz, V., Hainzelin, E., Hubert, B., Quintero, M., Sinclair, F. (eds). 2022. *Agroecological transformation for sustainable food systems*. Insight on France-CGIAR research. Montpellier, France, Les dossiers d'Agropolis International, 26. Agropolis International. Based on 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. Agron. Sustain. Dev., Vol. 40, No. 6, p. 40, déc. 2020.

cycles with minimal negative externalities and stresses the importance of local knowledge and participatory processes that develop knowledge and practice through experience, as well as scientific methods, and the need to address social inequalities" (see **Figure 2**).

Contrary to organic agriculture, there is no clear possibility of labelling a set of practices as agroecological. The concept works better when practices are classified on a spectrum and they are qualified as more or less agroecological (FAO, 2019). At farm scale, there is a diversity of representations of what agroecology is, which testifies to the multiplicity of ideological opinions and power balances. The opinions diffuse diverse practices, promote different agricultural policies, and are supported by contrasting interest groups. Another manifestation of the diversity of opinions is revealed when other scales are considered. Five stages were identified in embarking upon agroecological transitions towards more sustainable food systems Gliessman (2016).

The first three stages operate at the level of the agroecosystem and involve: (Level 1) increasing input use efficiency; (Level 2) substituting conventional inputs and practices with agroecological alternatives; and (Level 3) redesigning the agroecosystem on the basis of a new set of ecological processes. The remaining two steps operate on the food system and involve: (Level 4) re-establishing a more direct connection between producers and consumers; and (Level 5) building a new global food system based on participation, proximity, fairness and justice. While the transition, in the first two levels, is incremental and does not alter the paradigm of production, in the next three levels, it can unlock the systems to facilitate radical transformation.

In the selected corpus of this report, some studies employ concepts that are close to agroecology (or agroecological practices or agroecological agriculture), such as "ecological/sustainable sustainable intensification", simply "sustainability" or "natural farming" (see Section 3.1).

2.5. HOW DO THE HIGH LEVEL PANEL OF EXPERTS' AGROECOLOGY PRINCIPLES AND FAO'S AGRIFOOD SYSTEM APPROACH MATCH?

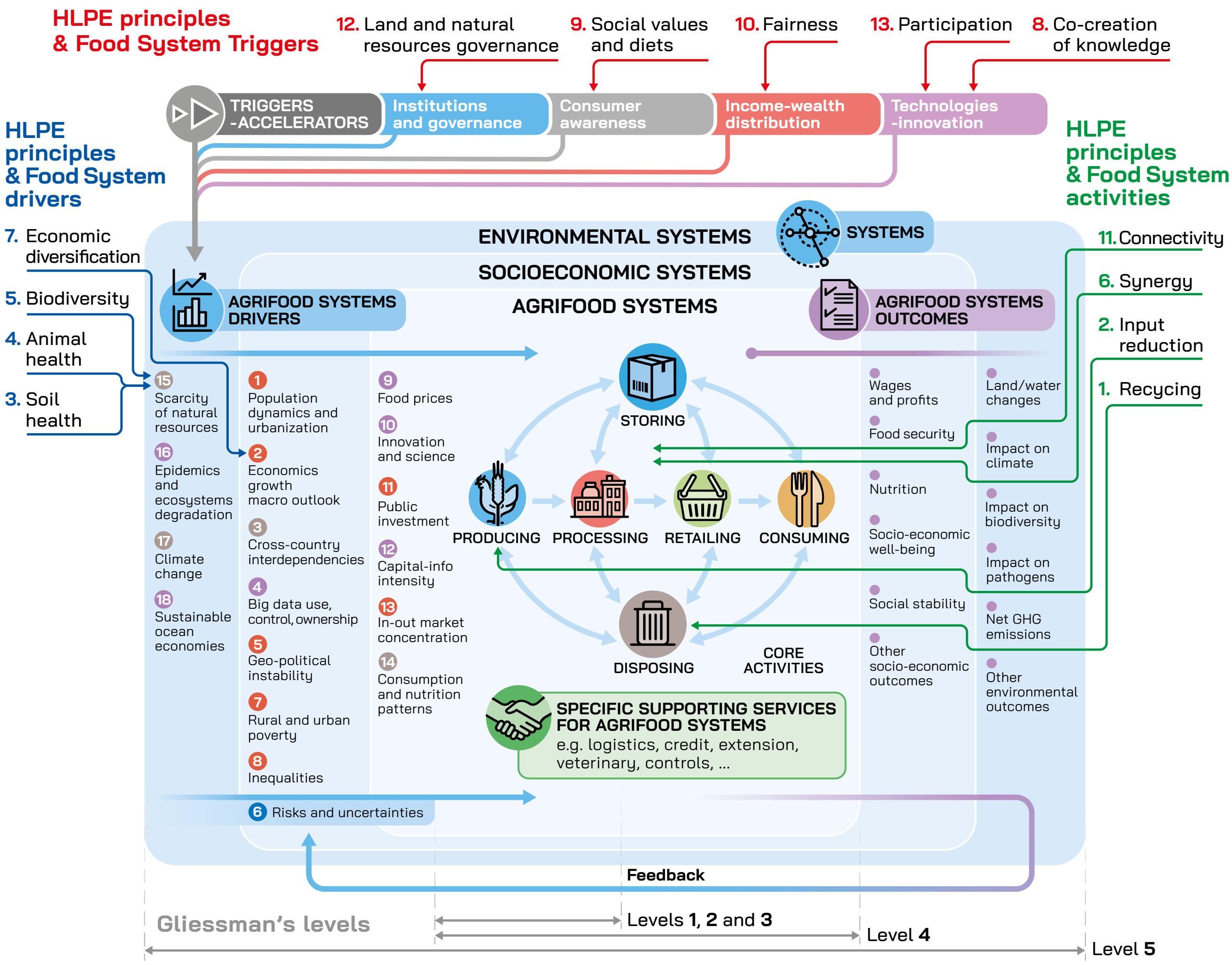
Interest is growing in combining both food systems and agroecology approaches, as shown in a recent report by CIRAD and the Joint Research Centre (JRC) that explores this interface (Sirdey *et al.*, 2023). The authors compare the conceptual framework of David-Benz *et al.* (2022) for food systems to HLPE's principles of agroecology. They identify a wide variety of linkages and challenges. To go further in the thinking, we looked at how the HLPE's principles of agroecology are considered in FAO's approach to agrifood systems in the report on global perspective studies in the F*uture of food and agriculture* (FAO, 2022a).

For example (**Figure 3**), five principles of agroecology can be seen as options among FAO's **triggers** to move agrifood systems towards sustainability and resilience: *land and natural resources governance, social values and diets, fairness, participation and co-creation of knowledge*. Four agroecology principles can relate to assumptions about **drivers**: *soil health, animal health and biodiversity relate to epidemics and degradation of ecosystems; economic diversification* could relate to economic growth.

Finally, four principles of agroecology refer to core **activities**. FAO's framework has, therefore, the potential to integrate all dimensions of agroecology as described by HLPE. However, the mindsets are different and refer to the classical dichotomy between **strong and weak visions of sustainability** (Ayres *et al.*, 2001). This is illustrated by FAO's scenario "Trading off for sustainability", which emphasises the role of innovation and technology "to meet the needs of the great variety of agroecological and social conditions".

Figure 3

Examples of correspondence between the High Level Panel of Experts' principles of agroecology and FAO's agrifood systems approach



Source: Adapted from FAO, 2022a. The future of food and agriculture – Drivers and triggers for transformation. The future of food and agriculture, No. 3. Rome. https://doi.org/10.4060/cc0959en.

3. Methodology

In order to draw upon lessons on the use of foresight tools to support policies for the agroecological transformation of food systems, we conducted our study in four steps to build stocktaking and collect discussions:

1. Collecting the texts into what is called the "corpus".
2. Analysing of the foresight activities using a grid for analysis and comparison.
3. Debating results of the comparison and drawing up lessons during a workshop.
4. Communicating and discussing lessons during a webinar following the workshop.
5. Communicating and discussing the results in multiple seminars.

3.1. STEP 1: COLLECTING THE CORPUS

As with other comparative analyses (van Dijk and Meijerink, 2014; Lacroix *et al.*, 2019; Couturier, Aubert and Duru, 2021; ENISA, 2021), the first step involved the creation of a corpus. **The criteria for selection were: a foresight process relative to the transformation of food systems or one of its components, and having one or several scenarios with an assumption relative to agroecology or similar concepts as defined in 2.4 (see Table 1). We selected foresight processes that had been carried out in different world regions, with a variety of commissioners and implementers (see Section 4.1.1). There were also a variety of geographical scales (from global to farm scale), time horizons and methodologies (see Section 4.1.3). Sixteen foresight exercises, including thirteen main exercises and three subexercises, were selected.** These three "subexercises" (corresponding to fiche number 3a, 4a and 12a, see Table 1) are studies that are applications, derivations or developments of what we call the "main exercises" (*w* number 3, 4 and 12). The results of these foresight processes have been published as reports or in academic journals. Obviously, this selected corpus is not exhaustive and other foresight processes could have been included in the selection, but only a few more exist. Table 1 lists the full name of the foresight activities chosen, their given name in this guidance document, and the corresponding *fiche* number.

Table 1. The selected foresight exercises

Fiche	Full name of the foresight process and reference	Given name in document	Terminology for sustainability of food systems
1	A Long Food Movement: Transforming Food Systems by 2045 (IPES-Food and ETC Group, 2021)	Long Food Movement	Agroecology (+ Food Sovereignty)
2	What future for small-scale agriculture? (Woodhill, Hasnain and Griffith, 2020)	Small-scale agriculture	Sustainability
3	Agrimonde - Scenarios and Challenges for Feeding the World in 2050 (Paillard, Treyer and Dorin, 2014)	Agrimonde	Ecological Intensification
3a	AgroEco2050 with Agribiom India (Dorin *et al.*, 2013; Dorin *et al.*, 2024)	AgroEco2050	Agroecology/Natural Farming
4	Land Use and Food Security in 2050. Agrimonde-Terra (Le Mouël, de Lattre-Gasquet and Mora, 2018)	Agrimonde-Terra	Agroecology/Sustainable Intensification
4a	Prospective de l'agriculture pour la programmation stratégique. L'exemple de travaux menés en Tunisie (de Lattre-Gasquet and Hubert, 2017)	Agrimonde-Terra Tunisie	Agroecology
5	The TYFA project (Ten Years for Agroecology in Europe) (Poux and Aubert, 2018)	TYFA	Agroecology
6	Understanding & improving the sustainability of agro-ecological farming systems in the EU (Kalt *et al.*, 2021)	UNISECO	Agro-ecology (including diverse farming systems)
7	Modelling environmental and climate ambition in the agricultural sector with the CAPRI model (Troillet, 2021)	CAPRI	Agro-ecological practices
8	Afterres 2050 (Couturier *et al.*, 2016)	Afterres	Generalised Agroecology (as a combination of different farming systems)
9	Enriching the Shared Socioeconomic Pathways to co-create consistent multi-sector scenarios for the UK (Pedde *et al.*, 2021)	SSP-UK	Sustainable Intensification
10	Four Agri-food futures for Latin America and the Caribbean (Patrouilleau *et al.*, 2023)	LAC – Agri-futures	Agroecology
11	The Impact of Agroecology on the Achievement of the Sustainable Development Goals (SDGs) – An Integrated Scenario Analysis (Millenium Institute, 2018)	Threshold21-iSDG	Agroecology
12	Rapport de co-élaboration de scénarios du département de Fatick en 2035 (Sénégal) (Cirad and ISRA, 2022)	FAIR-Sahel / Fatick	Agroecological Agriculture
12a	Anticiper l'avenir des territoires agricoles en Afrique de l'Ouest : le cas des Niayes au Sénégal (Camara, Bourgeois and Jahel, 2019)	Niayes 2040	No word but a description similar to agroecology
13	Supporting better crop–livestock integration on small-scale West African farms: a simulation-based approach (Sempore *et al.*, 2016)	Burkina - CLI	Sustainable Intensification

Source: See References.

3.2. STEP 2: ANALYSING THE FORESIGHT ACTIVITIES USING A GRID FOR COMPARISON

The second step involved defining a **grid for analysis** and completing it for each study in a *fiche*. The following criteria were selected:

- General characteristics of the foresight process (see Section 4.1)
- Characteristics of the participatory approach (if any) during the foresight process (see section 4.1.4)
- Characteristics of the system (see Section 4.2.) and the drivers (see Section 4.3.)
- Sustainability and agroecology in the scenarios (see Section 4.4.1. and 4.4.2.)
- Implications of the scenarios (see Section 4.5.)
- Strengths and limitations of the foresight process and results
- References

A *fiche* was prepared for all the above-mentioned foresight exercises and improved after discussion with the main author of the foresight study. Using the *fiches*, we systematically compared the foresight processes to draw lessons by **building comparison tables on each key issue**. In order to provide guidance for future foresight processes for food system transformations through agroecology, we decided to refer to **seven common steps in a foresight process.** The results of the comparison and the discussions that took place in the workshop (see Section 3.3.) are presented in Section 4.

3.3. STEP 3: DEBATING THE RESULTS AND IDENTIFYING LESSONS DURING A WORKSHOP

The third step was to partner with FAO in a participatory workshop at FAO headquarters in Rome and online, in November 2022. See Annex 1 for the workshop agenda.

The primary objective of the workshop was, in a collective and participatory manner, to put the **results of comparing the exercises into perspective and to discuss and deepen the lessons identified, to determine how foresight could be a process that would further facilitate the transformation of food systems through agroecology.** The secondary objective was to **bring together the authors of different foresight exercises and agroecology specialists.** This was done with a view to creating a community of practice that would foster the transformation of food systems through agroecology with the support of foresight, where everyone would benefit from each other's lessons and the multiplicity of approaches. Such a meeting is all the more interesting as these authors and workshop participants belong to different scientific communities. Discussions were structured around four themes: drivers and outputs; participatory approaches; geographical and time scales; and implications for practices, policies, and governance.

The workshop hosted three types of participants: foresight practitioners and modellers who had been involved in the foresight processes; agroecology specialists; and representatives of GIZ, the financial partner of the project. There were two representatives from the governments of Indian States, and representatives from FAO. Thirty participants were at FAO and about 15 were online (Annex 2).

The workshop agenda began with the organizing team presenting the study results. Then foresight activities were presented by their participating authors and the four themes were discussed. Two discussants were selected to present their own viewpoint on the topics. Later, all participants were asked to respond to a question proposed by the organizers on a card. The moderator collected all the cards and divided them into clusters. Finally, discussions took place on each cluster to draw up a few guidelines through collective intelligence.

The four themes and the discussants are:

1) **Drivers and outputs** in foresight for food system transformations through agroecology.

   Discussants: Steven McGreevy, University of Twente (the Netherlands) and Molly Anderson, Middlebury College (United States of America [USA]).

2) **Participatory approaches** in foresight for food system transformations through agroecology.

   Discussants: Mercedes Patrouilleau, Researcher, National Institute of Agricultural Technology (INTA) Argentina, and Lauren Baker, Director of Programmes, Global Alliance for the Future of Food.

3) **Geographical and time scales** in foresight to transform food systems transformations through agroecology.

   Discussants: Fergus Sinclair, Chief Scientist, Center for International Forest Research – World Agroforestry and Pablo Tittonell, Principal Research Scientist in Argentina's National Council for Science and Technology.

4) **Implication** of foresight exercises for to transform food systems transformations through agroecology on practices, governance and policies.

   Discussants: Nejia Hayouni, Director of Studies and Planning, Ministry of Agriculture, Hydraulic Resources and Fisheries, Tunisia and Cecilia Elizondo, Adviser, Intersectoral Group on Health, Food, Environment and Competitiveness (GISAMAC), México.

The conclusions of Theme 1 are included in Section 4.3 of this report. Those of Themes 2 and 3 are in Section 4.1. Those of Theme 4 are in Section 4.6.

3.4. STEP 4: COMMUNICATING AND DISCUSSING MAIN LESSONS DURING WEBINAR

A webinar entitled: *Foresight processes for sustainable food system transformations through agroecology* took place on 8th November 2022. Its objectives were to **present and discuss lessons learned and recommendations** for use in foresight processes to support the transformation of sustainable food system through agroecology. About 300 people participated online.

The webinar programme was as follows:

- Ronnie Brathwaite, Team Leader of the Ecosystem Approaches to Crop Production Intensification Unit in the Plant Protection and Production Division of FAO and Ingrid Prem, Programme Manager for Rural Development at GIZ, gave presentations on how agroecology is mainstreamed in their work programmes and its role in supporting transformation to sustainable food systems.

- Marie de Lattre-Gasquet, Senior Researcher from CIRAD gave a presentation on the outcomes of the workshop discussions. Key features were highlighted of the analysis of foresight activities to transform food systems and agroecology.

- Jim Woodhill, Leader of the Foresight4Food Initiative; Lorenzo Giovanni Bellu, Senior Economist of the Agrifood Economics Division of FAO; Molly Anderson, Academic Director at Middlebury College and Member of the International Panel of Experts in Sustainable Food Systems IPES-Food; Maria Estrella Esther Penunia, Secretary General of the Asian Farmers' Association for Sustainable Rural Development (AFA); and Eduardo Cerdá, Director from the National Directorate of Agroecology, of the Ministry of Agriculture, Livestock and Fisheries of Argentina held an Interactive Panel discussion with representatives from partner organizations.

- Anne-Sophie Poisot, Agricultural Officer and Assistant Team Leader of the Pest and Pesticide Management Unit of the Plant Production and Protection Division, FAO and Bruno Dorin, Senior Researcher from CIRAD presented the conclusions.

The webinar participants concluded that long-term perspectives and foresight activities can be useful in the transformation of food systems through agroecology. The participants agreed that the aim of foresight is not to predict the future, but to obtain a shared understanding of where the future might take us. Foresight can inform us as to the type of future(s) people would like to see and would be desirable, even though **scenarios are archetypes**. It is important to think about the future in a participatory manner, to mobilize civil society, and to improve decision-making today as, it is said, "when it is urgent, it is already too late".

Foresight, however, is still poorly understood and we need to **develop a "futures" literacy**. Further work is required to improve and diversify foresight approaches and methods. Comparing the results of foresight processes is useful both from the viewpoint of methodology and from that of results. A number of blind spots were identified in the different foresight processes such as traditional indigenous knowledge, crop and livestock integration, activities between production and consumption. Work is not sufficiently transdisciplinary and there is a tendency to assume current drivers will play the same role in the future and possible ruptures are not considered. Further work is necessary on drivers, assumptions and data. **Interactions between the foresight community and the agroecology community should therefore be continued.**

3.5 FURTHER STEPS

During the following months, a guidance document and a Summary Note were drafted, nourished by the inputs of the workshop and a literature review. It was presented at several events: the Agroecology Transformative Partnership Platform's (AE-TPP) first annual members' meeting (Montpellier, February 2023), the Foresight4Food workshop (Montpellier, March 2023), seminars organized by GEMDEV and Caritas International (Paris, May and September 2023), the French Academy of Agriculture (Paris, October 2023) and the International Science Day (online, November 2023). Updated versions of the guidance document and Note were then presented during an online global workshop on 5 December 2023 attended by more than a hundred participants. The present document was also improved by these discussions.

4. Methods and frameworks applicable to foresight processes for the transformation of food systems through agroecology

A foresight process requires thoughtful preparation, involvement of the stakeholders and participants, constant monitoring, skilful management, and continuous adaptation (Elsawah *et al.*, 2020b). Most processes have seven phases, which we will follow in this guidance document for the sake of clarity (of course, the process is not linear). The phases are: identifying aims, questions, methods, and actors; building the system; selecting drivers through retrospective analysis and assumptions for the future; building scenarios; learning from the scenarios; highlighting options for actions; communicating and debating results. First each of these processes is presented, followed by an analysis of the stocktaking foresights and the lessons that can be derived. Finally, recommendations are proposed.

4.1. PHASE 1: IDENTIFYING THE DESIGNERS OF THE PROCESS AND DEFINING ITS SCOPE

A foresight activity often has a commissioner, funders or donors and a group of implementers. Usually they will discuss the aims and questions to be tackled (including geographical scale and time horizon), the available resources (human, time, financial), the methods and the stakeholders who will be involved. This step is a critical factor for success.

4.1.1. Actors involved in commissioning and implementing the foresight activities in the corpus

Since the future is not neutral, it is important to look at the actors involved in a foresight exercise so as to analyse how they perceive the transformation of food systems through agroecology. Who are commissioning the foresight process? Who are the funders? Who are the implementers?

A variety of commissioners and funders were involved in the foresight processes of our corpus. Most obtained funding from several sources (see Table 2). Please note that:

- **Four exercises received significant funding from organizations that promote agroecology.** Ten Years for Agroecology in Europe (TYFA) and Afterres were funded by the *Fondation Charles Léopold Mayer pour le Progrès de l'Homme* whose aim is to promote peaceful social and ecological transition. *Threshold – iSDG* was funded by Biovision Foundation for Ecological Development which advocates fundamental agroecological transformation of food systems. *Long Food Movement* was funded by the Schmidt Family Foundation 11th Hour Project, which connects organizations that work with a variety of perspectives and strategies to act on a shared vision that builds healthy soil and thriving communities.

- **The European Commission (EC) funded several projects.** The EC research, technology and innovation programme Horizon 2020 explicitly focuses on resolving prospective global and societal problems. The Director General for Agriculture and Rural Development of the European Commission commissioned *CAPRI* at the Joint Research Center. Two foresights were carried out in response to a EC call for a proposal. In response to Horizon 2020, two projects were launched: *UNISECO* implemented *Sustainable food security-resilient and resource-efficient value chains* (H2020-SFS-2017-2); *FAIR-Sahel/Fatick* was carried out by CIRAD and Sahelian research institutions in the framework of a DESIRA *(Development of smart innovation through research in agriculture)* project. A few of the activities of Agrimonde-Terra Tunisie were funded by an EC Twin project.

- **Five foresight exercises in our corpus** (*Agrimonde, Agrimonde-Terra, Agrimonde-Terra Tunisie, AgroEco2050* and *Burkina-Crop and Livestock Integration [CLI]*) **were partially funded by CIRAD and a second organization** (French National Institute for Agricultural Research [Institut National de la Recherche Agronomique, INRA] for the two global foresights; National Institute of Agronomic Research of Tunisia (INRAT); Regional Youth Support Services (RySS) and FAO in India and the Ministry of Foreign Affairs in Burkina Faso). *Afterres* is partially funded by Solagro.
- **Two foresight exercises were funded by a special programme**. The United Kingdom Natural Environment Research Council ordered and funded *SSP-UK* in the framework of the UK Status, Change and Projections of the Environment – UK-SCAPE programme; *LAC-Agri-futures* was funded by the Public Policy and Rural Development in Latin America (PP-AL) network.

The role of commissioners and funders is very important for the development of foresight processes that transform food systems through agroecology. Agroecology is still the source of much controversy, partly linked to its polysemy and to representations that vary from one region to another. The inclusion of agroecology, as a means to transform food systems, helps to overcome blocks and identify possibilities for action (Caron, 2021).

If commissioners and funders are insensitive to this process, it will take them longer to include agroecology in foresight work related to the transformation of food systems, and new models of food systems will not be visualized, assessed and discussed. Networks, such as the Agroecology Coalition and the Agroecology Transformative Partnership Platform and donors, should consider foresight as a powerful tool to visualize new narratives and inform investment in collaborative initiatives.

Foresight processes can be carried out by one or several organizations that usually belong to three categories: non-governmental organizations (NGOs) and associations (named Category A in Table 2), research institutions and think tanks (Category B), or public or private enterprises (Category C) (Couturier, Aubert and Duru, 2021).
In our work:

- **Thirteen implementers belong to the category "research institutions, think tank" (A).** European universities and research institutions (e.g. UK Center of Ecology and Hydrology at Lancaster, Wageningen University, INRA, CIRAD, Oxford Martin School) have implemented six out of the 13 foresight exercises. The JRC of the European Union has explored the potential effects of selected farm to fork and biodiversity strategy targets in the framework of the 2030 climate targets and the post 2020 Common Agricultural Policy (CAP). Research institutions from Africa and Latin America were involved in three exercises. Moreover, the International Panel of Experts on Sustainable Food Systems (IPES-Food), which is a diverse and independent panel of 23 experts from 16 countries, who are guided by new ways of thinking about research, sustainability and food systems, and the Action Group on Erosion, Technology and Concentration (ETC-Group) implemented the *Long Food Movement*. The Institute for Sustainable Development and International Relations (IDDRI), an independent policy research institute, and a multistakeholder dialogue platform in relation to a consultancy office, implemented TYFA.
- **Two implementers belong to the category "NGO, association" (B).** Solagro is a association that arose from the wish of farmers, researchers and professionals to facilitate the emergence and development of practices and procedures that contribute to the economic, solidarity-based and long-term management of natural resources, implemented *Afterres*. Millennium Institute is a non-profit NGO and implemented the Treshold21-iSDG model. Its work involves improving the welfare of individuals on every continent by working with stakeholders to meet the challenges of sustainable development.

- **One exercise was implemented by a consortium** comprising research organizations, small and medium enterprises, NGOs and one organization representing farmers and landowners across the European Union (categories A, B and C).

- **None of the exercises were implemented by an institution from the private sector.**

Implementers usually work with a number of stakeholders and experts, i.e. farmers or their representatives; representatives from NGOs and associations; extension agents; representatives of the processing and retailing sectors; researchers from different disciplines, policymakers, etc. (see Section 4.1.4).

Table 2. Commissioners, funders and implementers of selected foresight processes

Name of the foresight process	Commissioners and funders	Implementers
Long Food Movement	Schmidt family Found. - 11th Hour Project	IPES-Food, ETC Group, CREPPA (A)
Small-scale agriculture	Open Society Foundations	ECI Oxford (A)
Agrimonde	CIRAD and INRA (A)	
AgroEco2050	RySS, CIRAD and FAO (A)	
Agrimonde-Terra	CIRAD and INRA (A)	
Agrimonde-Terra Tunisie	(1) CIRAD and INRAT; (2) European Com. twin project	1) CIRAD and INRAT; (2) MAPRH & CGAAER (A)
TYFA	Fondation CL Mayer pour le Progrès de l'Homme & ANR	IDDRI & AScA (A)
UNISECO	European Commission Horizon 2020	European consortium (A, B and C)
CAPRI	European Commission	JRC (A)
Afterres	Solagro + 4 regional funds + Fondation CL Mayer pour le Progrès de l'Homme	Solagro (B)
SSP-UK [29]	UK Government for Climate Change Risk Assessment 2022	Lancaster / UK Centre Ecology & Hydrology; Wageningen University; Cranfield Water Science Institute; Oxford Martin School; Prospex bvba (A)
LAC-Agri-futures	Red PP-AL	
Threshold - iSDG	Biovision Foundation	Millennium Institute, Biovision Foundation, Agricultural Sector Coord. Unit, others (B)
FAIR Fatick	European Commission Desira program, AFD, CIRAD, IRD	CIRAD & ISRA (A)
Niayes 2040	CIRAD and AFD	CIRAD & ISRA (A)
Burkina - CLI	CIRAD and French MEAE	CIRDES, IDR, CIRAD, INERA (A)

Note: Implementers: Category A: NGO, associations – B: research institutions, think tank – C: public or private enterprises.
Source: Authors' own elaboration.

BOX 1 PHASE 1: RECOMMENDATIONS FOR SETTING UP THE FORESIGHT PROCESS

Recommendations for commissioners and funders of foresight processes

- **Commission and fund additional foresight processes on the future of food systems through agroecology**, in order to envisage, assess and contribute to the creation of new food systems, overcome blockages, and identify possibilities for action. **Encourage implementation by institutions from the Global South.** Additional work is required to improve narratives, create new models, empower diverse stakeholders, and shed light on implications for the public and private sectors.

- Link foresight and agroecology communities by including agroecology in foresight networks and adding foresight activities to agroecology networks. During the workshop, many participants, who were foresight implementers, did not know each other. The participants from the agroecology community did not know the participants from the foresight community. The efforts to create communities of practice among foresight implementers, e.g. the Foresight4Food platform, should be strengthened. Promoters of agroecology, e.g. the Agroecology Coalition: the Transformative Partnership Platform on Agroecology (AE TPP), – *Dynamique pour une Transition Agroécologique au Sénégal*, (DyTAES), Agroecology for Europe, etc. have not all included foresight as a practice.

- **Provide a space to think and act freely with adequate time** so that foresight and agroecology practitioners and participants are able to conduct the entire foresight process. Effective foresight requires follow-up and continuous deliberation and experimentation, which is a long-term process.

Recommendations for agroecology communities on the start of a foresight process

- Become involved in foresight processes so as to contribute to the transformation of food systems through agroecology and to gain a long-term view about agroecology. There is interest in agroecology as a way to move towards more sustainable agriculture and food systems. However, the evidence of agroecology's contribution to sustainability – in the future – remains fragmented because of heterogeneous methods and data, differing scales and timeframes and knowledge gaps (Mottet *et al.*, 2020). More work is required to ensure that a long-term view on agroecology and foresight can help.

Source: Mottet, A., Bicksler, A., Lucantoni, D., De Rosa, F., Scherf, B., Scopel, E., ... & Tittonell, P. 2020. Assessing transitions to sustainable agricultural and food systems: a tool for agroecology performance evaluation (TAPE). Frontiers in Sustainable Food Systems, 4, 579154 & Authors' own elaboration.

4.1.2. Aims of the foresight processes and questions tackled

Aims

The corpus was analysed to identify the aims of the uses of the future (see Section 2.1). We investigated whether the aims were concentrated on advocacy and mobilizing; interrogating – structuring debates – navigating diverse futures – reducing future risks; shedding light on political implications, helping public decision-making, planning; or empowerment, developing capabilities, co-creating transformative futures.

Afterres, Agrimonde, Agrimonde-Terra Tunisie, AgroEco2050 all had the above-mentioned aims. The aim of TYFA and Agrimonde-Terra was to advocate, structure debates and support decision-making, while *UNISECO, FAIR Sahel/Fatick, Niayes 2040* focused on structuring debates, facilitating decision-making and building capacities. The remaining concentrated on structuring debates and helping decision-making.

During the discussions, the implementers of *FAIR Sahel/Fatick* shared their initial aim, which was to structure debates and build capacities. Several actors, involved in this foresight process, mobilized the results and advocated for the implementation of agroecological systems in Senegal, which had not been foreseen by the team that led the exercise. In *Agrimonde*, the commissioners (CIRAD and INRA) did not have the same aims, which evolved and were formulated over time (de Lattre-Gasquet and Hubert, 2017).

Main foresight questions

The transformation of food systems can be examined from different perspectives. **All the foresight processes in the corpus consider several questions.** These include the futures of food security and/or land use; and/or farms and farmers; and/or poverty; and/or climate; and/or biodiversity; and/or situation of a territory; and/or research priorities. All these questions – except for the situation of a territory and research priorities – **actually correspond to the outcomes of the agrifood system** presented in FAO's sketch (FAO, 2022a) as introduced in Section 2.2. Table 3 presents the foresight questions that have been addressed by each of the 16 foresight processes in the corpus. The corresponding outcomes of the agrifood system are in blue.

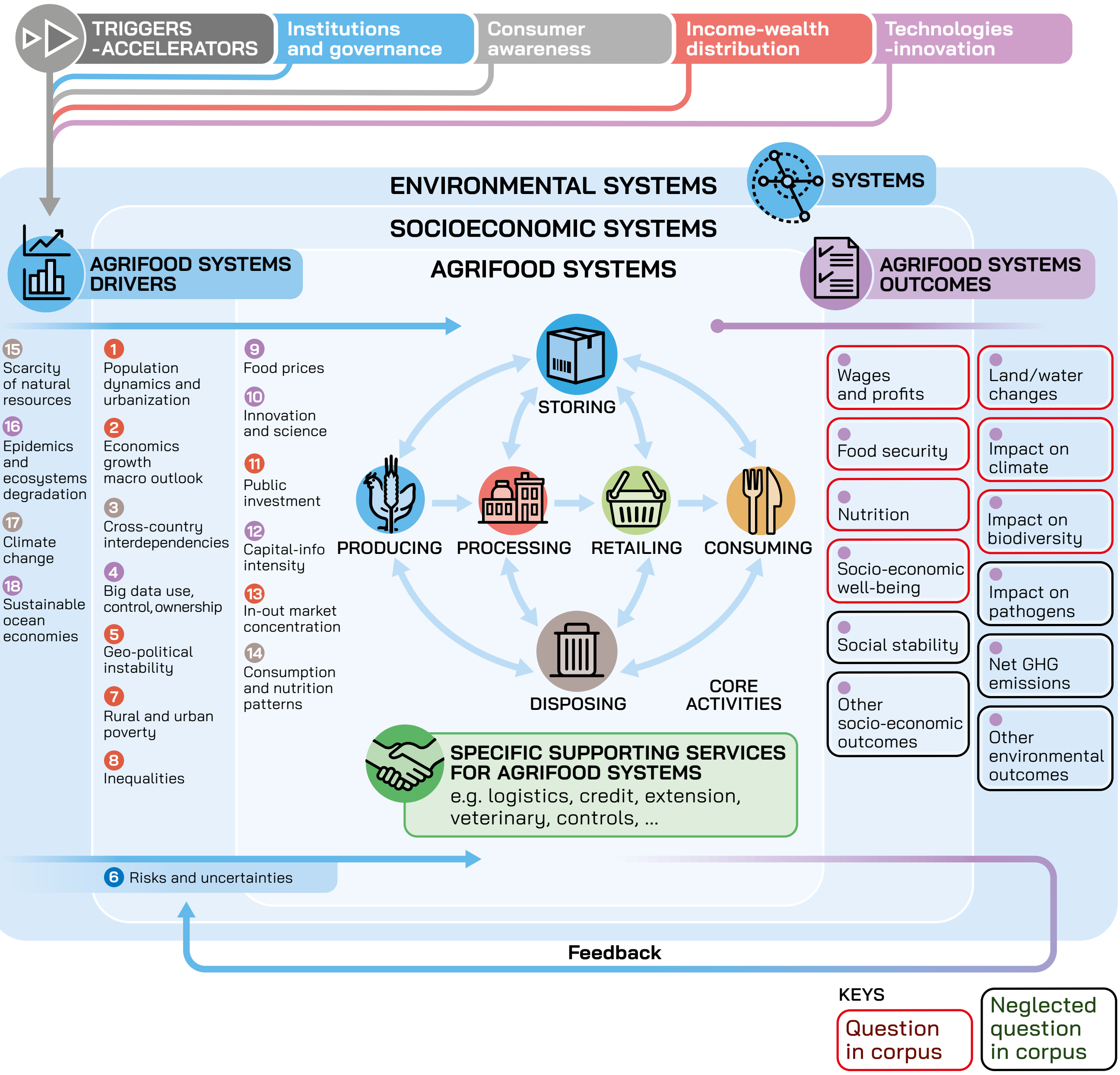
Table 3. Questions considered in the foresight processes of the corpus

The futures of:	Wages and profits? / Economic impact and poverty?	Food security? / Nutrition?	Socio-economic well-being? /Farmers?	Social stability?	Land use and water changes?	Climate, pathogens, biodiversity?	Net greenhouse gas emissions?	Territories?	Research priorities?
Long Food Movement		X							
Small-scale Agriculture	X	X	X						
Agrimonde		X				X			X
AgroEco2050	X		X		X	X		X	X
Agrimonde-Terra Tunisie	x	X			X				
TYFA		X			x	X	X		
UNISECO	X	X	X		X	X		X	X
CAPRI	X		X		X	X			X
Afterres		X			x	X	X	X	
SSP-UK						X		X	X
LAC Agri-futures								X	X
Thresh21-iSDG	X	X	X			X			
FAIR Sahel / Fatick			X		X	X		X	
Niayes 2040								X	
Burkina – CLI			X						

Note: X: is a major question in the foresight. x: is a minor question in the foresight. The corresponding outcomes of the agrifood system are in blue.
Source: Authors' own elaboration.

Some outcomes, related to the agrifood systems, are often considered by the foresight processes in the corpus, e.g. food security, land use changes, socioeconomic well-being, and biodiversity (circled in red in **Figure 4**). Increasingly, net greenhouse gas (GHG) emissions are considered. Other outputs of agrifood systems are hardly ever considered, for example: water changes, social stability, and pathogens (circled in black in **Figure 4**). Climate is often considered as a driver of agrifood systems, but rarely as an outcome of agrifood systems. The situation of a territory is an output of an agrifood system but is not mentioned as such by FAO (FAO, 2022a). Research priorities are rarely considered as questions in foresight processes.

Figure 4. Most and least considered foresight questions in relation to agrifood systems



Note: Red boxes: the most asked questions. Black boxes: the least considered questions

Source: Authors' own elaboration.

BOX 2 PHASE 1: RECOMMENDATIONS RELATIVE TO AIMS AND QUESTIONS FOR FORESIGHT AND AGROECOLOGY COMMUNITIES

- Recognize that the transformations of food systems through agroecology are **political questions that have financial implications and important benefits for human and animal health**; revenues; employment; climate and the environment. But several institutions tend to block, impede or prevent these transformations towards agroecology (Guillou in Hubert and Couvet, 2021).
- **Start work with a common diagnosis of the situation and the formulation of the foresight question.** The participants may have different representations of the problems to address, the objectives to reach, or the systems to design. They should express their expectations.
- **Build agreement on aims and questions of the foresight processes with funders and all stakeholders.** Build trust with key partners to establish credibility, guarantee autonomy in thought and action, and ensure the capacity to exercise independent judgment and influence. Remember that foresight helps at imagining what future people would like to see (or not), what futures are desirable (or not). It does not predict the future. Also, discuss and debate the definition and principles of agroecology.
- **Involve participants from all core activities and levels of food systems.** Effective uptake of foresight in decision-making and policymaking requires involving all types of stakeholders. For example, farmers (including, where appropriate, holders of indigenous and local knowledge), grassroots movements, representatives of the core activities of food systems (i.e. processing, retailing, transport, storing, disposing and/or recycling sectors and supporting services), as well as consumers, non-governmental organizations (NGOs) and associations, policymakers, and researchers in agroecology who have the ability to question their knowledge and practices. **This helps create a common language, enlarge perspectives and prevent blind spots.** Pay more attention to the **quality of the participants'** interactions than to their number. There is also a need for greater trust and collaboration between those working in the field and those involved in research, to bring about effective, useful and informed change.
- **Include policymakers and other major decision-makers, right from the beginning** of the foresight process as responsible governance is a key element of agroecology. Policymakers have to cope with a rapidly changing world but they appear to be pursuing short-term policies. But, do they have the capacity to make informed decisions? The principle of "bounded rationality" often leads them to choose the first solution that roughly satisfies the criteria they value. Participating in a foresight process will allow them to better grasp complexities, concepts of trends, ruptures, uncertainties and interactions. It will improve their preparedness for unexpected events and hinder them being blindsided by dilemmas (Monteiro and Dal Borgo, 2023).

Source: Hubert, B. & Couvet, D., La transition agroécologique. Quelles perspectives en France et ailleurs dans le monde. Tome I. Chapitre 8. Académie d'Agriculture de France, Presse des Mines; Monteiro, B. & Dal Borgo, R. 2023. Supporting decision making with strategic foresight: An emerging framework for proactive and prospective governments. OECD Working Papers on Public Governance No. 63. https://dx.doi.org/10.1787/1d78c791-en.

4.1.3. Geographical and time scales

In our corpus, *Burkina – CLI* works at the farm scale, *Fair Sahel/Fatick* and *Niayes 2040* at the territorial scale, *SSP-UK*, *Agrimonde-Terra Tunisie* and *AgroEco2050* at national scale (although *AgroEco2050* was implemented in one Indian State). On the other hand, *CAPRI, TYFA and LAC-Agri-futures* are carried out at the regional scale, and *Long Food Movement* is carried out at the global scale. Agrimonde and *Agrimonde-Terra* look at global and regional scales. At the regional, national and territorial scales is *UNISECO*, and *Afterres* is at national and territorial scales (see **Table 4**).

Half the foresight exercises in the corpus used 2050 as the time horizon. The time horizon of the others is shorter: *CAPRI* (2030); *Threshold21-iSDG* and Fair *Sahel/Fatick* (2035); *LAC-Agri-futures* and *Niayes 2040* (2040); *Long Food Movement* (2045); or longer: *SSP-UK* (2100). *Burkina-CLI* does not include a time horizon.

When dealing with scales there are several important elements:

- **Looking across scales and considering all.** Foresight requires us to explore the relationships between actors at global, regional, national, territorial and local scales as well as over time.

Table 4. Geographical scales in policy, agroecology and foresight

<table>
<tr><th>Scales
Processes</th><th>Farm / Grassroots community</th><th>Territory / Infra-national</th><th>National</th><th>Regional</th><th>Global</th></tr>
<tr><td rowspan="3">Literature foresight processes</td><td rowspan="3">Burkina-CLI</td><td>Fair Sahel/Fatick
Niayes 2040
AgroEco2050</td><td>SSP-UK
Threshold21-iSDG
Agrimonde-Terra
Tunisie</td><td>CAPRI
TYFA
LAC-Agri-futures</td><td>Long Food Movement
Small-scale agriculture</td></tr>
<tr><td colspan="2">Afterres</td><td colspan="2">Agrimonde
Agrimonde-Terra</td></tr>
<tr><td colspan="4">UNISECO</td></tr>
<tr><td rowspan="2">Main actors at each geographical scale</td><td rowspan="2">Farmers
Craftspersons</td><td>Locally elected</td><td>Nationally elected</td><td>Regionally elected</td><td>International organizations
Multinational corporations</td></tr>
<tr><td colspan="2">Farmers' representatives
Professional organization
Industry – SME in agri-food and transport</td><td>Regional organizations</td><td></td></tr>
<tr><td rowspan="2">How agroecology is viewed (from Gliessman's levels)</td><td rowspan="2">Resource use efficiency through practices.
Reducing or eliminating use of costly, scarce, environmentally damaging inputs

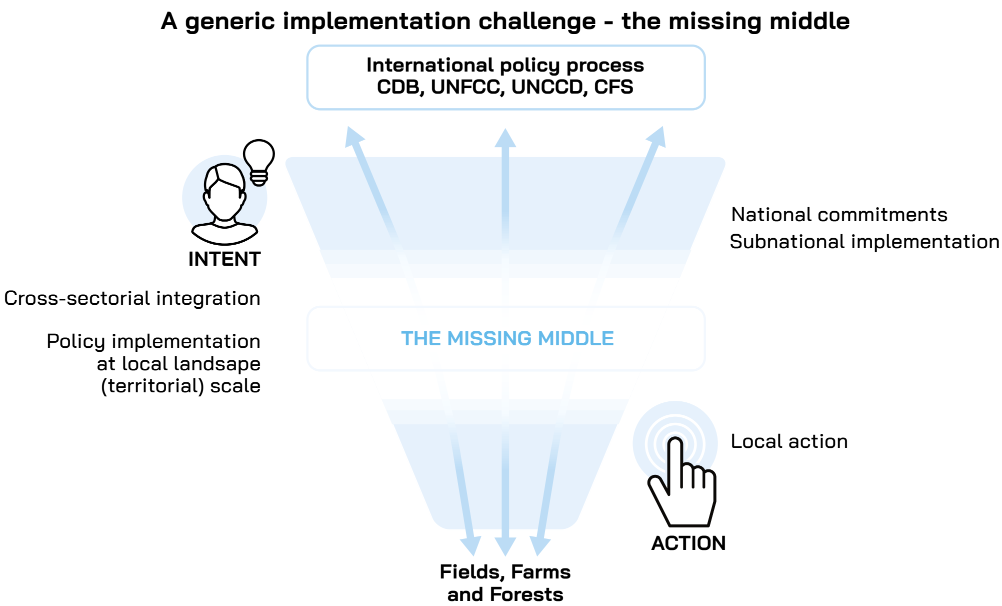
Substitution of inputs by co-existing biota to improve plant nutrient uptake, stress tolerance and defences against pests and diseases.</td><td colspan="2">Redesigning whole agroecosystem: consumption at territorial level, landscapes, transport, processing, selling, networks, etc.</td><td colspan="2">Rebuilding the global food system so that it is sustainable and equitable for all (trade agreements, contracts, transport, processing, selling, etc)</td></tr>
<tr><td colspan="4">Re-establishing connections between growers and eaters, developing alternative food</td></tr>
</table>

Source: Authors' own elaboration.

Agroecology also requires us to look across scales, as it is an integrated response to inter-related global challenges. Moreover, a few agroecological innovations require actions at several scales and not only at one (Meynard and Jeuffroy, 2021). However, during implementation, there is often a "missing middle" (Weigelt *et al.*, 2021) (see **Figure 5**).

- **Translating scales.** The potential risks of translating scales in foresight relate to over-consistency, which is the use of the same assumptions at all scales (Kok, Rothman and Patel, 2006) and lack of data for proper translation. During the *Agrimonde-Terra Tunisie* process, scenarios were created by adapting the assumptions of Agrimonde-Terra to the Tunisian context. Moreover, *UNISECO*, *Afterres* and *SSP-UK* also downscaled from a large region to territories.
- **Integrating the long-term dimension, past and future.** This means looking at historical patterns, ongoing trends, but also weak signals (i.e. an early indication of a potentially important new event or phenomenon that could become an emerging pattern, a major driver or the source of a new trend), black swans (i.e. extremely low-probability and unforeseen event with high impact that takes everyone by surprise), and discontinuities (FTP, 2014).
- **Consider time for transitions and transformation** (see **Section 2.3**). A profound transformation can be gradual and emerge from slow processes that take time and knowledge, but it can also result from abrupt and fast ruptures such as crises or conflicts. In any system, the transformation of some drivers is more rapid than others (see **Sections 4.2** and **4.3**). Some organizational and technological innovations are rapidly developed and adopted while others take time. Climate seemed to have reached inertia but is currently changing rapidly. The actors in food systems do not all possess the same notion of time and therefore institutional arrangements, diets, farm practices transform at unpredictable speed.

Figure 5. The missing middle in foresight for linking policies and action



Source: Weigelt, J., Sinclair, F., Mikulcak, F. & Lossak, H. 2021. Ecosystem-based adaptation in agriculture: how agroecology can contribute to tackling climate change. *Policy Brief*. https://www.globallandscapesforum.org/wpcontent/uploads/2021/11/6-White-Paper_GLF-Climate-Ecosystem-based-adaptation-in-agriculture_En.pdf

BOX 3

PHASE 1: RECOMMENDATIONS RELATIVE TO GEOGRAPHICAL SCALES AND TIME FOR FORESIGHT AND AGROECOLOGY COMMUNITIES

- **Consider the 5 levels of agroecology: changes at the farm level can only be incremental.** Transformative transitions require that agroecosystems are redesigned, by that producers and consumers are reconnected through the development of alternative food networks, and that a new global food system is built based on participation, proximity, fairness and justice.

- **Implement foresight processes at the meso scale, on territories with a landscape perspective and cross-sectoral integration.** The greatest diversity of stakeholders, i.e. farmers and their representatives, representatives of processing, retailing, storing, transport and finance, consumers and their representatives, and policymakers can be involved in foresight processes at the territorial level. Also, local practices and knowledge can be considered, and cross-sectoral dialogue and actions can take place. **Foresight processes should also be implemented at the global, regional, and national scales because they can provide useful elements regarding the larger context and archetypes of assumptions and scenarios that are useful at the territorial scale.** However, at these scales, it will be more difficult to involve a large variety of stakeholders and impact will not be as direct. At global or regional scales, mostly researchers and experts are involved in the foresight processes. .

- **Be cautious if you wish to translate scenarios from one scale to another** because of the risk of over-consistency. The translation of scenarios from one scale to another is very difficult with agroecology, which is context-specific. No single set of scenarios can address all pertinent spatial scales, and it may be necessary to link multiple scenarios.

- Integrate the long-term dimension, past and future. Also **consider how radical social and societal change can be, as well as the speed** – slow or rapid – of the development and adoption of technical and organizational innovations, including those in agroecology. Time is an important dimension of the transformation of food systems through agroecology. Adopting sustainable agricultural practices and attitudes requires time to gain good knowledge of the land and climate, the socioeconomic and environmental systems and the actors. Time is required for trials and errors, time to overcome fears and reluctance, and time to use new material and practices. Many uncertainties and ruptures cannot be envisaged. However, if the time dimension and the idea of ruptures are appropriated, or become part of the foresight processes, reactions to unplanned circumstances will be quicker. Factors of inertia and those that act as a brake to the transformation of food systems and adoption of agroecology should not be overlooked.

Source: Authors' own elaboration.

4.1.4. Foresight methodology

In this section, we explore the methods used for anticipation and participatory approaches.

Anticipatory methods

Three types of anticipating methods were used in the literature:

- **Narratives** (e.g. qualitative methods of anticipation) built either through **visioning** or with **morphological analysis**.[2] This method was used by *Long-Food Movement* to describe what food systems would look like by 2045 under two scenarios: business as usual and one that describes what could happen if food system change was guided, instead, by civil society. Examples include *Small-scale agriculture* that has looked at the future of small-scale agriculture in Ghana and Zambia. *FAIR Sahel/Fatick* which has explored the trajectories of the territory and better understands possible evolutions. *Agrimonde-Terra Tunisie* describes different situations on land use and food security in 2050 in Tunisia. Also *LAC-Agri-futures* looks at the main processes that could determine different agrifood futures for Latin America countries in the medium-term, and provides guidance for research agenda on the platform in partnership "Public policy and rural development in Latin America (PP-AL). *Niayes 2040* has employed **backcasting** to identify the decisions or events that need to take place to transform a selected scenario into reality.

- **Modelling** (e.g. quantitative methods of anticipation). Models have been used by *TYFA* to assess how much feed/food/fuel and material the agricultural sector should produce to tackle, with equal priority, challenges associated with climate change, health, the protection of biodiversity and natural resources. Models were also used for the provision of a sustainable and healthy diet for Europeans without affecting global food security. Models employed by *CAPRI* provide qualitative indications and **orders of magnitudes of the challenges** that will be faced by implementing a few of the targets set for the agricultural sector under farm-to-fork and biodiversity strategies. Models used by *Afterres* describe the agricultural system in France if GHG emissions from the agricultural sector were to be halved. Models used by *Tresholds21-iSDG* simulate the impacts of a set of agroecological interventions for a typical semi-arid African country on the achievement of all the SDGs. In these processes, the questions differed and, therefore, results cannot be compared. Attention is drawn to the fact that modelling can be considered transparent because rules and equations are written. However, modelling is subjective. It **requires the selection of assumptions and simplification of situations**. It is the **comparison of the results, and the understanding of assumptions**, that leads to good comprehension (Alcamo *et al*., 2006; Haegeman *et al*., 2013).

- Narratives and modelling, in two ways:

  - **Narratives and then modelling.** This method has been used by SSP-UK (narratives, semiquantitative trends and projections) to explore how the global economy and society might develop over the next 80 years. *Agrimonde-Terra* employed a model and narratives about the futures of land use and food security. *Niayes 2040* used narratives followed by modelling to identify the brakes and levers involved in transitioning towards sustainable intensification that considers the specific features of the local territory. The narrative is prepared and then quantitative illustrations of a few components of the situations are implemented. However, the qualitative and quantitative processes are successive and interactions are limited.

2 Morphological analysis is a qualitative method that alternates analysis and synthesis in order to imagine the multiple states of a given system. It begins by breaking down the system into subsystems or drivers, for which alternative hypotheses of changes are constructed. Then, plausible and internally consistent combinations of the hypotheses are made and give shape to different scenarios describing the future states of the system. The scenario construction process is traceable (p.22 in Mora, 2016).

- **Interactions between modelling and narratives**. Is used by *Agrimonde* on the impacts of population growth, urbanization, lifestyle changes, climate change and growing energy and meat demands on land use, on nutritional and on food security for all in 2050. This method is also used by *AgroEco2050* to look at intensification of industrial agriculture and the full shift to agroecology in an Indian state. Interactions between modelling and narratives are used by *UNISECO* on the socioenvironmental implications of scaling-up agroecological farming and food-system innovations to the EU-level. *Burkina–CLI* uses this method on the integration of agriculture and livestock in the western cotton zone of Burkina Faso. This method can be perceived as a "learning machine", as it gives a voice to a variety of scientific and stakeholder knowledge and allows public debates that unveil processes and actors that might otherwise be invisible (Dorin and Joly, 2020). This is only if the risk of the strong influence of modelling experts over stakeholders is well managed.

These methods do not cover the variety of available anticipatory methods, but they are commonly used in foresight related to food systems. T**he articulation between quantitative and qualitative anticipatory methods, whether successive, iterative or convergent, can play an important role** in steering the transformations of social-ecological systems (Jahel *et al*., 2023). In this case, it is important to look at the power relationships between the modellers and the rest of the team. Modellers can have a strong influence because of the power of the modelling tool and of the figures in the presentation of results.

Participatory approaches

Participatory approaches are developed and studied in the branch **of participatory action research**. They are key for both foresight (see **Section 2.1**) and agroecology. The latter can be defined as a "transdisciplinary, participatory and action-oriented approach" (Mendez *et al*., 2020) where farming communities, consumers, social movements and decision-makers at micro and meso levels are involved. Different levels of participation exist, as shown in **Arnstein's ladder of citizen participation** (Arnstein, 1969). The selected corpus integrates different rungs of this ladder: "Informing" (transmitting information to participants), "Consultation" (asking for participant's opinion), "Placation" (participants have limited degree of influence) or "Partnership" (participants negotiate the outcomes).

Various participants from different backgrounds were involved in the foresight processes in the corpus: researchers, experts, farmers, transformers, merchants, citizens' organizations, NGOs and policymakers. The geographical scale seems to have had greater impact on the type of participants than the anticipatory method employed. When the geographical scale is local, there is a larger variety of participants. Mostly, researchers and experts were involved at the global or regional scales. In some cases, modelling is carried out only by researchers and experts (*TYFA, CAPRI*), but in others, a large variety of stakeholders are involved (*Afterres, Agrimonde-Terra Tunisie, Niayes 2040, Burkina-CLI, SSP-UK*) (see **Table 5**).

In Tunisia, training sessions on foresight and strategic planning were organized for 100 people from the Ministry of Agriculture as well as farmers and agro-industrial entrepreneurs. Training led to a common understanding of the ongoing problems, the creation of a community that needs to be continuously renewed because of changes in functions and retirement, and a change in the vision and strategy of the Ministry of Agriculture, which currently considers agroecology a priority.

In Burkina Faso, the work on crop–livestock integration, has led to co-designing and simulating alternative strategies and rapid evolution of farmers' management practices as well as discussions about obstacles to the effective implementation of difficult transformations. Apart from foresights carried out at the territorial level, policymakers were never involved in the foresight processes in our corpus. Yet, foresight processes are opportune arenas for debate between policymakers, communities and grassroots movements who are the actors at the heart of agroecological transition.

Table 5. Foresight, participants, geographical scales and anticipatory methods

Foresight processes	Participants				# Participants	Geographical scale	Anticipatory method
	Only researchers	Researchers +experts	Research +experts +farmers	+++ more stakeholders			
Long Food Movement			X		21	Global	Narratives
Small-scale Agriculture	X				+/- 20	Global	Narratives
Agrimonde	X				50	Global + Regional	Interactions model-narratives
Agrimonde-Terra		X			100	Global + Regional	Narratives then modelling
LAC-Agri-futures		X			50	Regional	Narratives
TYFA		X			N/A	Regional	Modelling
CAPRI	X	X			N/A	Regional	Modelling
UNISECO				X	800	Regional to Territorial	Interactions model-narratives
Agrimonde-Terra Tunisie				X	4 x 30	National	Narratives
SSP-UK				X	21 + teams	National	Narratives then modelling
Thresh21-iSDG					N/A	National	Modelling
Afterres				X	150	National + Territorial	Modelling
AgroEco2050		X	X		40	State India	Interactions model-narratives
FAIR-Sahel – Fatick				X	25	Territory	Narratives
Niayes 2040				X		Territory	Narratives then modelling
Burkina – CLI				X	18 farmers	Farm	Interactions model-narratives

Source: Authors' own elaboration.

Beyond the composition of the panel of participants, participation processes should obey a few principles in their implementation. There is no *state of the art* per se, but many handbooks and guidelines have been published over the last 20 years (Creighton, 2005). However, it is important to **recall that the development of participatory approaches is nourished by intense debates** in the field of action research and transdisciplinary studies. The implementers of such methodologies should, therefore, be introduced to this literature so they can adopt the best standpoint. Four points should be kept in mind:

- **The context of implementation is key, the method is secondary.** During a participatory process, especially if the panel of participants is diverse, there will be an interplay of power and interests. It is important to consider the complexity of the sociopolitical contexts in which the processes are implemented. The designers of the methodology should carefully pinpoint the interplay between the actors and participants, and be prepared to deal with imbalances of power, and anticipate the space left for potential conflict (Bryson *et al.*, 2002), which may impact new connections and transformative change (Hebinck *et al.*, 2018).

- **The role of the facilitator is central.** To deal with the sociopolitical context, and to implement the methodology, the facilitator must reflect on their neutrality as an actor, elaborate on their opinions, and be well prepared for the workshop.

- **Sufficient resources should be allocated.** Human and financial means should be adequate for efficient participation (Kaner, 2014). Time is not only required during workshops (participants should be motivated sufficiently to share their time) but also throughout the long-term process, including follow-up. This is particularly true when the approach comprises continuous deliberation and experimentation, as opposed to "one-shot" workshops (Treyer, 2022).

- **The objectives and motivations of each person involved needs to be clear.** This should avoid pitfalls, such as becoming "manipulative" when there is the intention of legitimizing a process through participation. It is also important to be honest and realistic with the participants and present them with the factual decisional power they will gain at the end of the process. Designers of the process should reiterate that participation should not be "tyrannical" as a methodology, but rather formulate the motivations behind its use, for them and for the participants (Cooke and Kothari, 2001; Hickey and Mohan, 2004).

Such processes, therefore, require **careful consideration of the ethics of participation and deliberation**. Ethics of deliberation implies individual and collective deliberation, free from ideological conditioning; deliberation about the ends and means so as to avoid artificial debates; and deliberation that is decisive and cooperative. The power must be given to the participants and equal attention should be accorded their contributions. This prevents instrumentation by the strongest (Frémeaux and Voegtlin, 2023). Such approaches are co-substantial to both foresight and agroecology.

BOX 4

PHASE 1: RECOMMENDATIONS RELATIVE TO ANTICIPATORY METHODOLOGY AND PARTICIPATORY APPROACHES FOR FORESIGHT AND AGROECOLOGY COMMUNITIES

- **Match anticipatory and participatory methods to aims and objectives. Try to choose the most appropriate method and acquire the necessary skills and resources. Do not underestimate the time required for the work.** It is important to maintain a diversity of methods to open the futures as much as possible. Quantitative models help to materialize the orders of magnitude involved in transformations, whereas narratives provide substance to the futures. Both are required to understand the levers and lock-ins for change. Articulation between them can play an important role in steering the transformations of social-ecological systems. The combination of qualitative and quantitative methods, with either narratives and then modelling (successive manner), or interactions between modelling and narratives (iterative or convergent) could become more important as they are more convincing than only stories or only numbers (Jahel *et al.*, 2023).

- **Rigorously use anticipatory methods and be intellectually undisciplined, which means distrusting received ideas. In addition make a few improvements to the anticipatory methods used.** Narratives – built either through visioning or with morphological analysis followed by the combination of assumptions – may be more appealing, inspiring and concrete. They should appeal to the emotions, as to be is to live by stories. Models (biophysical balance, economic, system dynamics, spatial) should be questioned. New models for agroecology may be developed to consider a wide variety of plants, animals, trees, pests and diseases, water and nutrients, and their interactions, to introduce new metrics.

- **Use participatory approaches for participation and co-creation of knowledge, as they are key principles of agroecology. Value scenarios as "learning machines" (Dorin and Joly, 2020), which depends on the ability of different communities to imagine alternative futures collaboratively.** Foresight processes are opportune arenas for debate between policymakers, communities and grassroots movements, which are the actors at the heart of the agroecological transition. Participatory approaches can sustain stakeholders' interest in and determination to make a change and help in the development of new strategies and rationale for action (Prost *et al.*, 2023). The lack of participation is not simply a methodological failure, it is an institutional problem.

  Facilitating participatory foresight processes requires time, resources and training skills. Choose the leader(s) of the foresight process carefully and develop facilitating skills to balance the power of the participants. Consider the diversity of viewpoints but remain on track.

  Stimulate stakeholder's capacity for creativity and design ability, whatever the method used.

- **Pay attention to the ethics of participation that implies granting equal attention to each contribution and giving each participant the power to influence discussions. Pay attention, also, to the ethics of deliberation, which implies: individual and collective deliberation, free from ideological conditioning; deliberation about the ends and means to avoid artificial debates; and deliberation that is decisive and cooperative.** Generally, pay attention to issues of power when inviting participants, especially farmers that are not necessarily familiar with academic norms, and *vice versa*. But be aware as well of the influence of those who nominate the participants or have technical knowledge or data; the strength of the funding bodies; the capacity of actors who can mobilize resources to achieve a certain goal; the authority some stakeholders may feel they have to privatize the future or prevent the expression of different opinions. Pay attention to the forcefulness of relationships within the foresight team as well, especially between modellers and qualitative experts. Such approaches are co-substantial to both foresight and agroecology.

Source: Jahel, C., Bourgeois, R., Bourgoin, J., Daré, W., De Lattre-Gasquet, M., Delay, E., Dumas, P., Le Page, C., Piraux, M. & Prudhomme, R. 2023. The future of social-ecological systems at the crossroads of quantitative and qualitative methods. Technological Forecasting and Social Change, Volume 193, 122624, https://doi.org/10.1016/j.techfore.2023.122624; Prost, L., Martin, G., Ballot, R. et al. 2023. Key research challenges to supporting farm transitions to agroecology in advanced economies. A review. Agron. Sustain. Dev. 43, 11. https://doi.org/10.1007/s13593-022-00855-8 & Authors' own elaboration.

4.2 PHASE 2: BUILDING THE SYSTEM

To delimit the system that will be considered during the foresight process, it is necessary to draw up a list of drivers (see **Phase 3**) that should be taken into consideration, whether quantifiable or not. The list should provide **an overall vision of the system under study and its environment.** Engage in interviews, workshops, brainstorming and literature reviews to obtain the list. All the selected stocktaking foresight studies adopt a systemic viewpoint. The system that each study focuses on varies, depending on the targeted questions, the approach (qualitative or quantitative), the geographical scale, etc. But **they all integrate systemic thinking** through the definition of variables (internal and external), their interactions, flows and feedback loops.

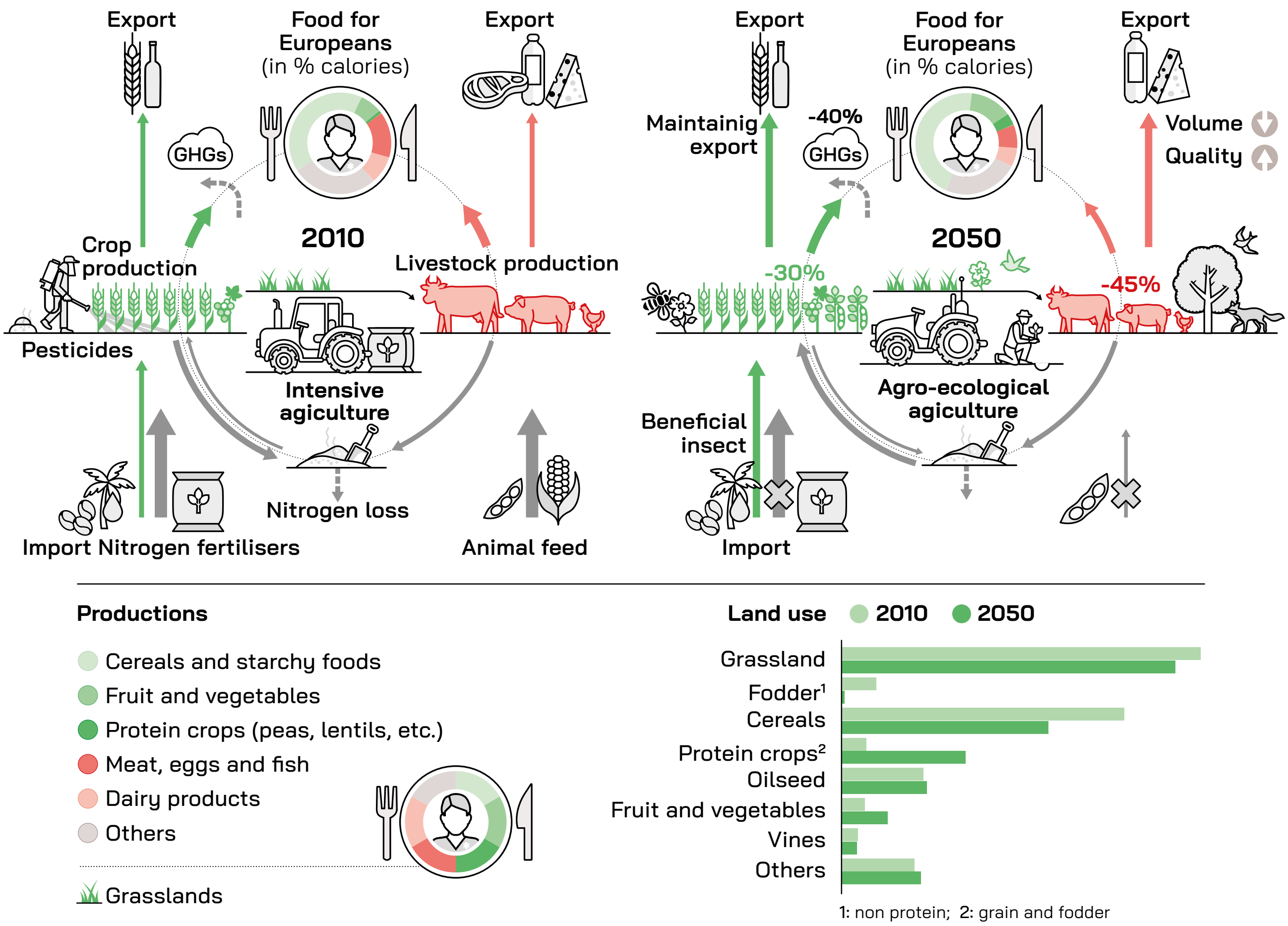
The main differences, with regard to the systemic approach, are **the levels of details and the mode of visualization of their respective systems**. The examples of *TYFA*, *Agrimonde-Terra*, *Threshold21-iSDG*, *Niayes 2040*, *SSP-UK* and *Long Food Movement* illustrate this statement. We identify as good practice to have, when possible, a **clear and explicit representation of the entire system, especially if this representation is dynamic and shows the system's evolution.**

4.2.1 Representation of the system in six studies in the corpus

In *TYFA*, the system is constructed to simulate the agricultural functioning of the European food system. The approach is based on a quantitative biomass balance model divided into five interconnected compartments (demand for food, crop production, livestock production, non-food demand of biomass and nitrogen flows. See **Figure 6**). The authors construct the TYFA scenario by combining alternatives in each subsystem. They managed to draw an explicit visual of their scenario compared to the 2010 baseline, by merging the structure of the system itself with the results of the comparison, showing the dynamics of the whole.

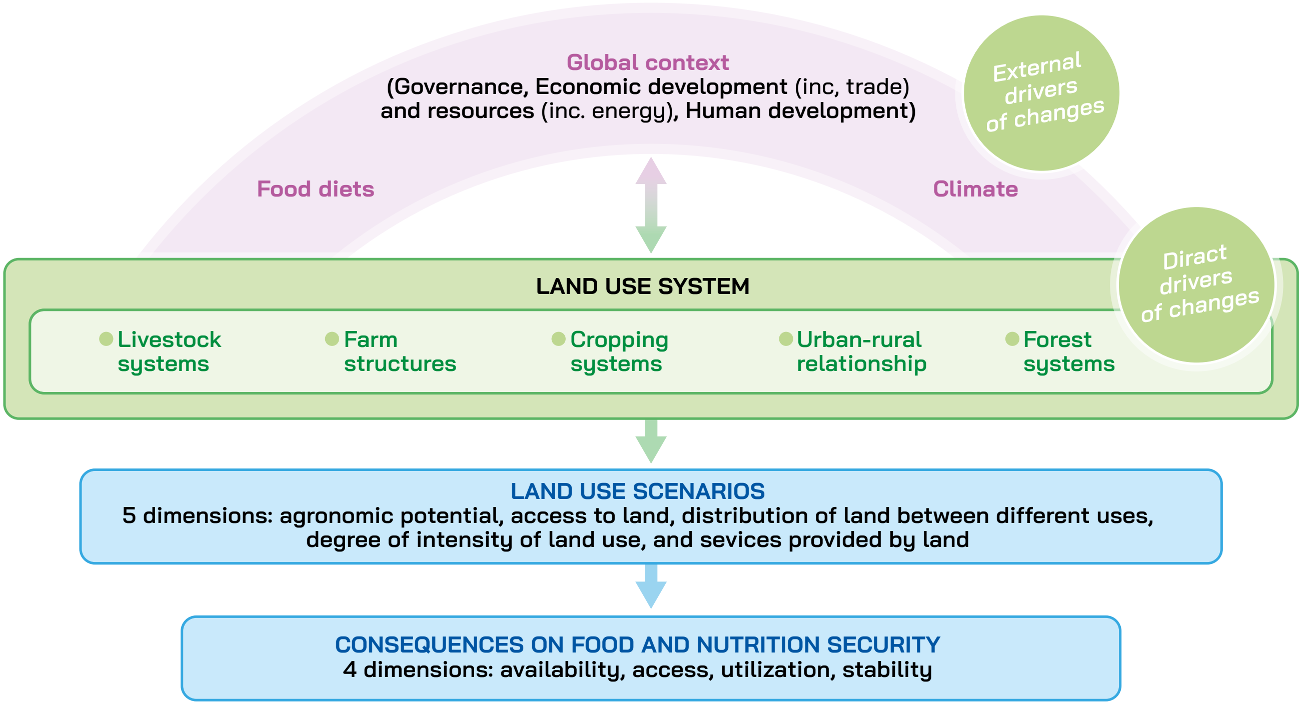
The system is explicitly represented in *Agrimonde-Terra*. Two main interacting subsystems are defined (global context and land use), which are themselves composed of interconnected subsystems. *Agrimonde-Terra* considers that land-use changes: result from complex and dynamic interactions between direct and external drivers; may be characterized using five complementary and interlinked dimensions; and have an impact on the four dimensions of food and nutrition security defined by FAO (2009) at different scales ranging from the household to the global level. This means that there is a web of processes, actors and interactions involved in land use and leading (or not) to food and nutrition security at global, national or household levels (see **Figure 7**).

Figure 6. Ten Years For Agroecology – Representation of the system in 2010 and its possible evolution with agroecology



Source: Poux, X. & Aubert, P.-M. 2018. An agroecological Europe in 2050: multifunctional agriculture for healthy eating. Paris, Institut du développement durable et des relations internationales. 74 pages.

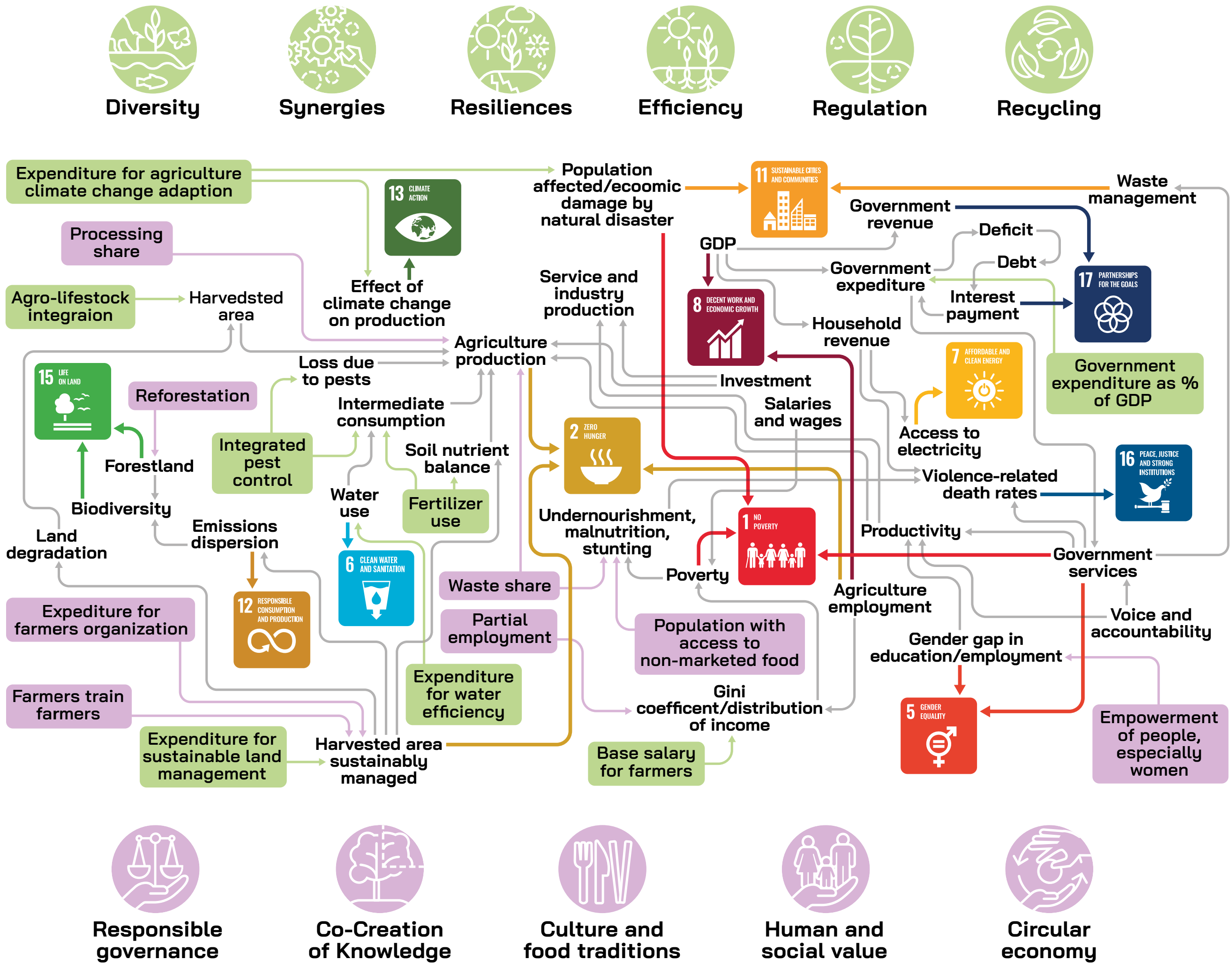
Figure 7. Agrimonde-Terra: representation of land use and food security systems



Source: Le Mouël, C., de Lattre-Gasquet, M. & Mora, O. 2018. *Land use and food security in 2050: a narrow road. Agrimonde-Terra*. Edition Quae.

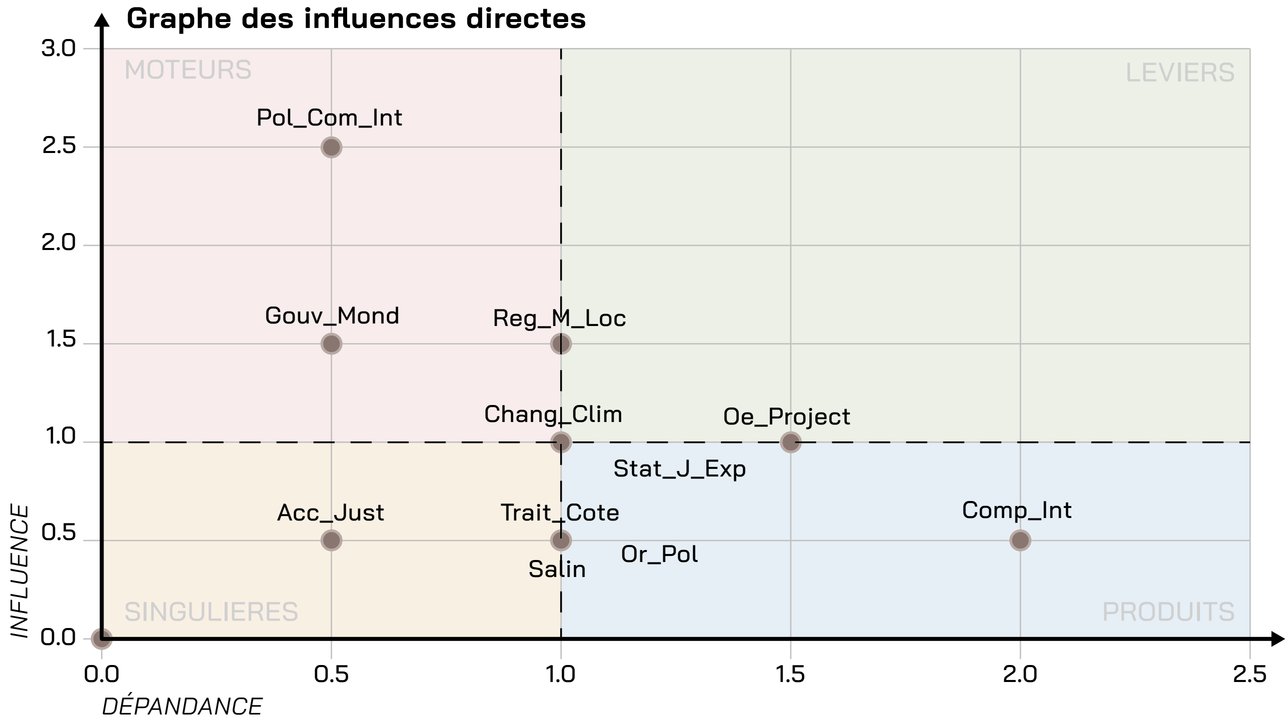
Threshold21-iSDG is based on a system-dynamics-based model for comprehensive and participatory development planning. It integrates economic, social, and environmental factors, and represents important elements of complexity such as feedback relationships, nonlinearity and time lags (see **Figure 8**). System thinking is therefore rooted in the methodology of this foresight study, and the authors represent the system thanks to a causal diagram explaining the impact of agroecological principles on the SDGs. This diagram may be useful for the detailed study but remains quite difficult for an external viewer to read.

Figure 8. Threshold21-iSDG: representation of a causal diagram



Source: Millennium Institute. 2018. *The Impact of Agroecology on the Achievement of the SDGs. An Integrated Scenario Analysis*. Washington, D.C.

Figure 9. Niayes 2040: influence/dependency diagram



Source: Camara, C. (coord.) and Bourgeois, R., Bourgoin, J., Camara, A., Camara, C., Ciss, I., Daouda, G.P., Diop, M. Fall Diallo M., Faye, A., Gaye, D., Diop, D., Jahel, C., Jankowsky, F., Gueye, N.A., Gueye, N.Y., Kane, O., Mbaye, T., Ndiaye, M., Ndoye K.T., Niang; S., Nourou, S.E. S., Sané, M., Ségnane, S., Seye N., Sow, M., Thiao, I.P., Tounkara, S. 2018. *Rapport des ateliers de coconstruction de scénarios prospectifs pour la zone sud des Niayes.* Dakar: CIRAD-ISRA-BAME, 50 p. https://doi.org/10.18167/agritrop/00433

In *Niayes 2040*, the system is not explicitly represented. A list of 43 "factors of change" was built with the participants. From it, seven "driving forces" were selected after a "structural analysis" involving the systematic identification of the influences of one factor on another. The authors were therefore able to draw an "influence/dependency diagram". This visual prefigures the existence of a system, but is quite difficult to read and translate into a representation (see Figure 9).

Another example of the system not being explicitly represented is SSP-UK. Twelve drivers are identified, and their trends are presented in a table for each scenario, but there is no explicit and visual reference of their interrelations. In *Long Food Movement*, the use of a systemic approach is clear since the authors explicitly focus on the possible future trends of the food system. Nick Jacobs, one of the authors, states that they even go further because they push this system's boundaries. However, there is no attempt at a representation of such a system in the report: drivers are identified and possible trends are highlighted through narratives.

4.2.2. The importance of systemic thinking and its representation

The effort of representing the constructed system may be linked to the approach adopted in the study. Modelling communities practise putting variables into sketches or graphic designs to better explain their models. Purely qualitative methods have fewer incentives to design visual presentations of their results, they focus more on narratives.

The integration of such visual representations or any other way to improve the understanding of the system construction would benefit foresight

processes for agroecology. On the one hand, foresight processes borrow heavily from systems analysis (FTP, 2014; Loveridge, 2009; de Jouvenel, 2004). Systemic thinking is supposed to be rooted in the approach, and it includes the methods needed to ensure the reader can easily comprehend the system. On the other hand, if the complexity of issues faced by agriculture has led to a wide adoption of a system approach in this sector (the expressions "farming systems"; "cropping systems"; "food systems"; "agricultural systems"; "ecosystems" are commonly used), **the transformation through agroecology calls for a dynamic representation of such systems.** The principles of agroecology themselves, as proposed by FAO and HLPE, require systemic thinking and, therefore, a convenient way for it to be expressed. Among them are:

- **Synergy**. Agroecology enhances positive ecological interaction, synergy, integration and complementarity among the elements of agroecosystems (animals, crops, trees, soil and water).
- **Circular and solidarity economy.** Agroecology reconnects producers and consumers and provides innovative solutions for living within planetary boundaries while ensuring the social foundation for inclusive and sustainable development.
- **Connectivity.** Agroecology ensures proximity and confidence between producers and consumers through promotion of fair and short distribution networks and by re-embedding food systems into local economies.

Systemic thinking should be explicit in foresight processes for agroecology. Foresight practitioners should use, and be aware of, the use of this mindset right from the beginning and throughout the process. **Visual presentations of the system help to detail and better represent such systems. It would provide better comprehension and appropriation** of the process even by readers that were outside the construction of the system. **Such representation can better illustrate the gaps and blind spots.** Indeed, the systemic approach overcomes disciplinary specialization, simple relationships between inputs and outputs, linear schemes and lack of scale interactions. **As graphic landmarks, they can also shed light on unrevealed causes of change, possible emerging properties, system traps and leverage points** (Meadows, 2008), **which can all clarify suggestions for action.**

BOX 5

PHASE 2: RECOMMENDATIONS RELATIVE TO BUILDING THE SYSTEM FOR FORESIGHT AND AGROECOLOGY COMMUNITIES

- **Employ systemic thinking right from the beginning and throughout the process.** The systemic approach means that a set of elements are connected and form a whole, thus illustrating properties that are properties of the whole, rather than properties of its component parts. Foresight borrows heavily from systems analysis as it leads to considering phenomena on the basis of a study of all the factors and their interrelations. Whatever definition of agroecology is chosen, it is important to have clear relationships between levels, elements and principles of agroecology, e.g. synergy and complementarity between elements of agroecosystems, circularity, solidarity, and connectivity. Systemic thinking helps identify the blind spots and levers.
- **Create visual – and if possible – dynamic representations of the system.** Visual representations of the system facilitate its appropriation and understanding. They show causal relationships between drivers, uncertainties and risk factors. They make it easier to identify gaps and blind spots, and may shed light on causes of change and leverage points.
- **Integrate the often neglected outcomes of food systems,** such as wages and profits, employment, access to food, nutrition, socioeconomic well-being, social stability, water use, and pathogens.

Source: Authors' own elaboration.

4.3 PHASE 3: DRIVERS: RETROSPECTIVE ANALYSIS AND ASSUMPTIONS ABOUT THE FUTURE

4.3.1 Definitions

Drivers (or driving forces) are factors that bring about change that affect or shape the future. Drivers differ in their nature (technical, social, economic, environmental, etc.); in their form (quantitative, qualitative or mixed for semiquantitative methodologies); in their level of details, and in their influence in the system (the way and how much they foster change). They can be characterized as **"direct"** or **"indirect/underlying".**

A direct driver univocally influences an outcome in the system. An indirect driver operates diffusely, altering one or more direct drivers. Drivers have taken different **modalities** in the past and will have diverse **future states**. In a foresight process, the system is built by analysing the influence of **variables** (understood as factors that can vary) on each other and by drawing hypotheses on what modality or value these variables can take in the future. These variables can either be input variables (hypotheses are made as an entry) or **output** variables (their modality is adjusted as an outcome). In the present report, we consider drivers to be input variables.

The analysis of drivers requires a **retrospective analysis** to identify ongoing **trends**, past and possible future **disruptions**, and assumptions about the future. A trend is the general tendency or direction of a movement or change over time. A megatrend is a major trend, at global or large scale that likely affects the future in all areas over the next 10 to 15 years. A trend may be strong or weak, increasing, decreasing or stable. There is no guarantee that a trend that was observed in the past will continue in the future. It is also important to identify weak signals, wild cards or black swans, i.e. deep disruptions to existing trends and established systems. Trends can be analysed by means of data analysis, literature reviews and interviews. Other methods include causal layered analysis, trend radars, trend impact analysis and horizon scanning.

4.3.2 The drivers of food systems identified in the literature

Van Dijk and Meijerink (2014) look at drivers of global food security and classify them under two categories: supply and demand. The most commonly used drivers, although superficially, are: **population growth (including urbanization); income growth; technical change; climate change (including land degradation and water scarcity); increasing use of bioenergy and biomaterials, as well as shifting diets and consumer preferences**. They note that **aquaculture, post-harvest losses and storage, alternative sources of food and farm structures** are not yet incorporated as drivers related to food supply; poverty and inequality are not yet incorporated as drivers related to food demand. Lacroix *et al.*, (2019) also look at drivers that influence the futures of the environment. They use the DEGEST grid (Cornish, 2004): **Demography, Economy, Governance, Environment, Society, Technology**. In their analysis of 307 environmental scenarios, they show that the drivers that have the greatest influence on the futures of the environment are governance (in 125 out of 307 scenarios), economy (76 out of 307 scenarios) and society (43 out of 307 scenarios).

FAO (2018b) developed a food system wheel with four large categories of drivers: natural elements; societal elements; core system with a layer of activities through which food products flow (production, aggregation, processing, distribution, and consumption including waste disposal) and a layer of services that support the flow; and the behaviours of diverse actors. In the FAO report published in 2022, 18 drivers are identified for the transformation of agrifood systems. Some are common (**population dynamics, nutrition patterns, climate change, innovation, etc.**), but others are employed less in the literature, such as **big data generation, control, use and ownership; food prices; public investment in agrifood systems; input and output market concentration; epidemics and degradation of ecosystems; fisheries and aquaculture**. Note that many of these drivers are considered by the 13 elements of agroecology as described by HLPE. The **opinion is however highly contrasted**, from the agroecology context-based paradigm of food systems, as opposed to a growth-led macroeconomic vision of these systems. This contrast echoes the **weak versus strong definitions of sustainability**.

Other literature that covers the transformation of food systems is focused on agrarian change. Scholars of this school of thought are interested in the agrarian question concerning the evolution of the peasant social class and differentiate several farming styles or **syndromes of production**, from capitalist to peasant farmers. Ong and Liao (2020) identify seven key drivers of change from the perspective of these syndromes: **land access and tenure; financial capital; horizontal social capital (farmer to farmer support); social justice and equity; decentralization of markets and environmental degradation.**

4.3.3 Analysis of the corpus

Clusters of drivers

We conducted an inventory of the main input variables or drivers employed in the 13 studies. We clustered these drivers into categories, and these categories into three major clusters: *core agrifood activities, socioeconomics, governance and technology and environment*. This operation led to the quantification of the occurrences of the variety of drivers in the reviewed foresight processes, differentiating **quantitative, qualitative and mixed assumptions**. Caution needs to be taken with these results as it is risky to compare studies having very different questions and methodologies. However, a broad overview can be obtained from the themes approached in these studies.

Twenty-four categories of drivers were identified. In total, 155 occurrences of these drivers were indicated, with a fair balance of qualitative, quantitative and mixed assumptions. They were classified under clusters (see Table 6) that range from very specific production features to general social and environmental contexts. Specific assumptions were analysed for each cluster.

The **core agrifood activities cluster** is composed of two subclusters:

- Farming systems (four categories of mostly quantitative drivers). The most used categories of drivers are the cropping and livestock systems, whereas forestry systems and farm structures are used less. Assumptions about yields, the level of inputs and the farming practices will influence the results on the productivity of arable land and carbon sequestration (Duru and Therond, 2023).
- From soil to stomach (five categories of drivers, mostly qualitative). The most used categories of drivers are food diets as well as non-food uses (such as biomass for energy). The supply chain organization is used less whereas it is considered essential to the agroecological transition of agriculture (Duru, Therond and Fares, 2015). Assumptions about food diets are mostly quantitative and are about the contributions of different agricultural products to dietary energy supplies (in kilocalorie [kcal] per capita per day). The proportion of animal proteins in the diet is an important assumption because of the importance of land used for feed. Diets also have an impact on the proximity of production, trade and health. Assumptions about non-food uses of biomass significantly impact land use for food and forests, carbon sequestration and carbon dioxide (CO_2) emissions.

Socioeconomics, governance and technology cluster (11 categories of drivers), in which **the most used categories of drivers are economic organization, trade, policies and governance, and the state's role in the economy. On the contrary, mobility and the financing system are used less.** In this cluster, most occurrences are qualitative.

Environment cluster (four categories of drivers, mostly quantitative), in which **the most used categories are land use and associated conflicts, whereas water is used less.** Assumptions can be made about the allocation of land (between crops, grasslands and forests) as it is one way of tackling climate challenge, particularly when afforestation is foreseen to increase carbon sequestration in soils and woody formations (Therond and Duru, 2019). Biodiversity is not seen as a driver but as an output, although it is essential to agroecological transitions as it contributes to conserving, protecting and enhancing natural resources. The higher the share of ecosystem-service-based production, the lower the environmental (nitrogen losses to water and air) and health (reduced human exposure to pesticides through water and food) externalities (Therond and Duru, 2019).

Table 6. Drivers used in the foresight activities in the corpus

		Drivers	Qualitative	Quantitative	Mixed	TOTAL	TOTAL per system
Core agrifood activities	Farming systems	Farm structures	3	2	0	5	61
		Cropping systems	3	6	3	12	
		Livestock systems	2	4	2	8	
		Forestry systems	1	2	0	3	
	From soil to stomach	Food diets	2	4	4	10	
		Non-food uses	1	3	2	6	
		Food processing	5	1	0	6	
		Waste and losses	2	5	0	7	
		Supply chain & rural/urban	3	0	1	4	
Socioeconomics, governance and technology		Population & migration	1	2	4	7	71
		Social structures	3	1	2	6	
		Economic organization	5	2	3	10	
		Technologies	3	1	2	6	
		Knowledge & trainings	3	1	1	5	
		Mobility & transportation	0	0	2	2	
		Policies & governance	5	2	1	8	
		State's role in economy	4	2	1	7	
		Trade	4	4	2	10	
		Financing system	2	0	2	4	
		Geopolitics & international regulations	3	1	2	6	
Environment		Land-use	1	7	2	10	23
		Climate	3	2	2	7	
		Greenhouse gas emissions	0	1	1	2	
		Water	0	2	2	4	

Note: high occurrences are highlighted in red; low occurrences are in blue

Source: Authors' own elaboration.

The corpus shows the **importance of having both quantitative and qualitative input variables.** Quantitative variables are mostly used in themes related to natural and technical sciences such as cropping systems or climate, **where metrics are epistemologically central**. Qualitative variables are used more for social, political and even economic themes like social structures or finance. **Such variables are far more complex to model and quantify, yet key to understanding the system.**

The drivers that are often considered in the foresight activities have much in common with drivers identified in the reviews by van Dijk and Meijerink (2014) as well as Lacroix *et al.*, (2019). For example: **demography; economy; governance; technology; environment; climate change; food and non-food use.** The high occurrence of cropping systems and livestock systems, which does not appear in the other comparative studies, is because the literature reviewed for this guidance document is focused on agroecology.

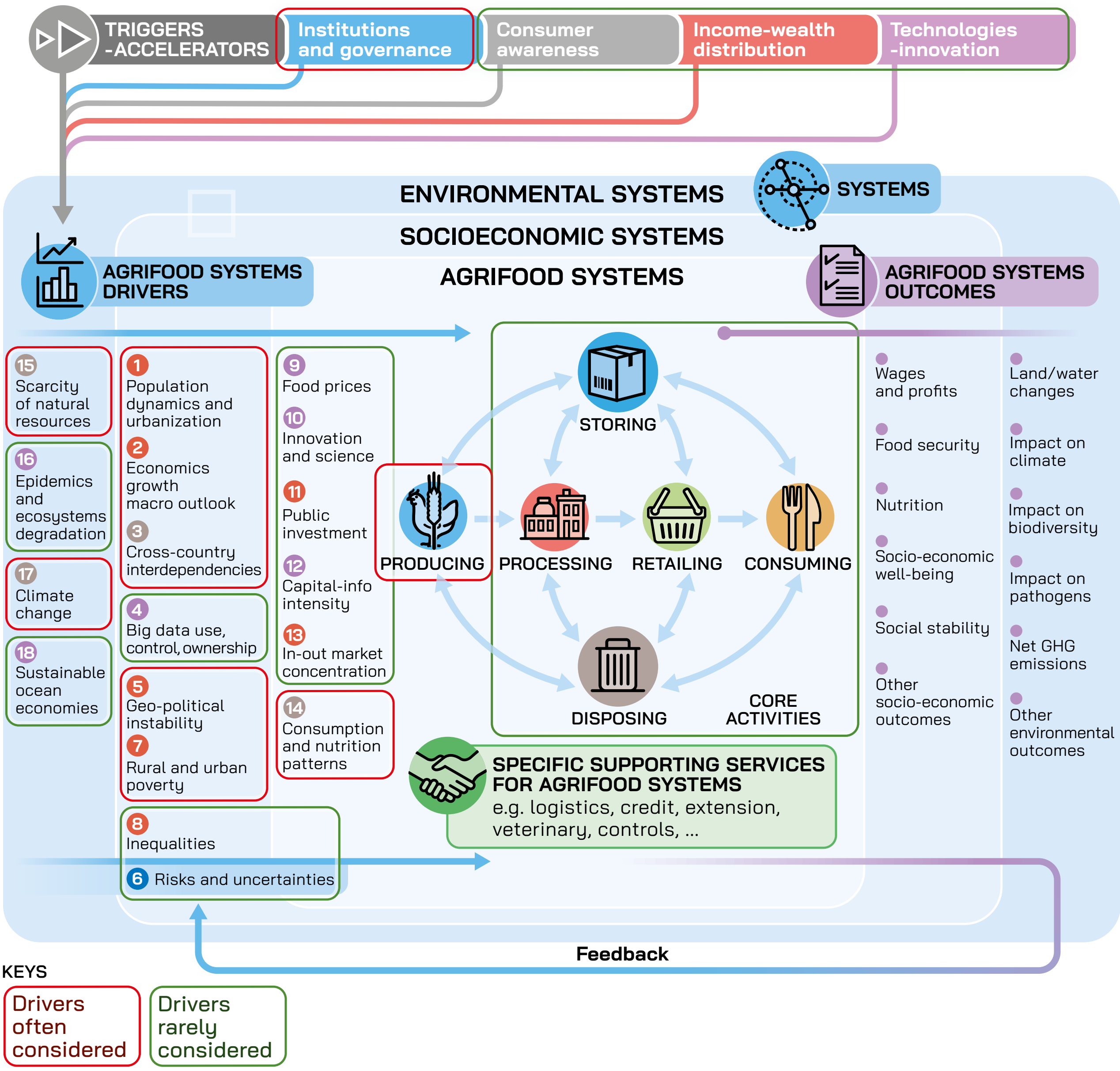
Several drivers from the Future of Food and Agriculture (FOFA) report (FAO, 2022a) are rarely considered in the foresights of the selected literature, like food prices, big data use control and ownership, epidemics and ecosystem degradation and sustainable ocean economies. These drivers are circled in green in Figure 10. Some drivers that are often used in the corpus are easily identifiable in the FOFA report: innovation and science, the state's role in the economy (called public investment in FOFA), consumption and nutrition patterns, population dynamics and urbanization, economic organization, geopolitics and international regulations, and climate change.

Other drivers are often used in the corpus, but are identified differently or not clearly in the FOFA report. These are: cropping systems and livestock systems (among "producing" in FOFA); mobility and transport; trade (among "cross countries interdependencies" in FOFA); social structures (among "rural-urban poverty" in FOFA); use of land and water (among "scarcity of natural resources" in FOFA); waste and losses (among "risks and uncertainties"); farm structures (among "Economic growth, structural transformation and macroeconomic stability"); supply chain organization (a core activity); and policy and governance (a trigger for transformation). Drivers that are often considered are circled in red in Figure 10. Risks and uncertainties are not considered a driver in the foresights of the corpus, but as assumptions about other drivers.

Drivers on the ladder of agroecological transformation

The referenced drivers in the corpus were linked to the five stages of agroecological transition identified by Gliessman (2016). The cluster "Farming systems" refers to levels 1, 2 and 3. "From food to stomach" refers to Level 4 (re-establishing a more direct connection between producers and consumers). The drivers of the social, technological, economic and political context refer to level 5 (building a new global food system based on participation, proximity, fairness and justice). We estimated to what extent each of these levels was considered in each exercise in the corpus (Figure 11). **We observe that many cases looked at levels 3, 4 and 5, while fewer exercises looked at levels 1 and 2. Very few exercises looked at all levels simultaneously.**

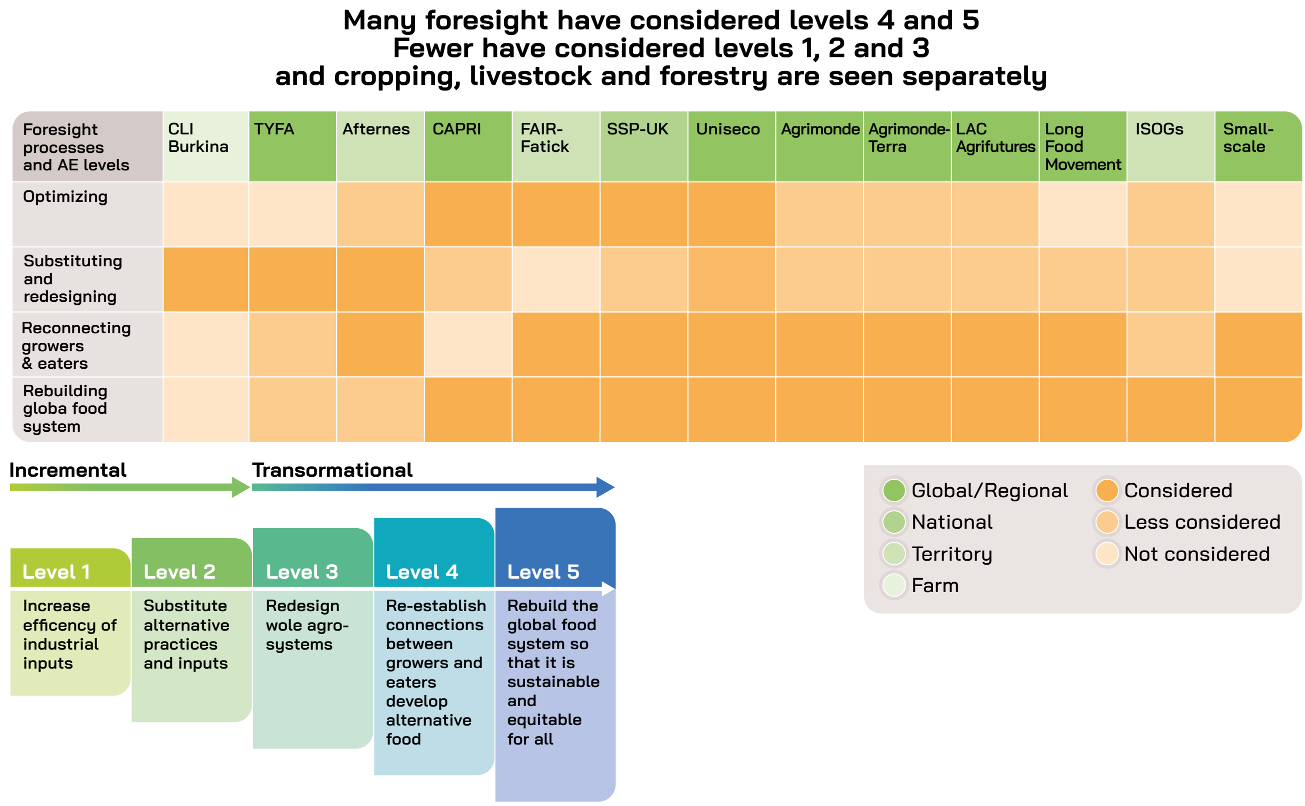
Figure 10. Drivers, triggers and core activities of agrifood systems in the foresight activities



Note: Often considered drivers are circled in red; rarely considered are circled in green.

Source: FAO, 2022a. The future of food and agriculture – Drivers and triggers for transformation. The future of food and agriculture, No. 3. Rome. https://doi.org/10.4060/cc0959en and Authors' own elaboration

Figure 11. Drivers considered in the foresights of the literature in relationship to Gliessman's stages of agroecological transition



Source: Gliessman, S. 2016. Transforming food systems with agroecology, Agroecology and Sustainable Food Systems, vol. 40, no 3, p. 187-189, mars 2016, and Authors' own elaboration.

4.3.4 The choice of drivers as a collaborative process to open up diverse futures

A key phase of the process is the selection of drivers included in the considered systems. Certainly, it depends on the questions raised by the foresight exercise, as well as the objectives. It is important to **use appropriate terminology** when describing a driver: is it an input or an output variable? Is it an entry or can it adjust? Is it quantitative, qualitative or mixed? What is its unit if it is quantitative? What is its extent if it is qualitative? Does it have direct or indirect influences? The number of selected variables also deserves attention. A **fine balance always needs to be achieved between avoiding important blind spots in the analysis and having too many drivers that lead to unreadable results.**

In all cases, it is important **to recognize that subjectivity and political viewpoints cannot be denied when it comes to selecting drivers** and, therefore, drawing conclusions. Blind spots can be scientific, and at the same time can exist in societies. Above all, it is essential **to be transparent about the hypothesis selected**. This is particularly true when it comes to controversial drivers. For instance, science and technologies, which in most scenarios, are not considered important drivers. However, the role of innovations, such as digital technologies, should be discussed as they may contribute to accelerating agroecological transition at both the farm and territory scale (Bellon-Maurel *et al.*, 2022). The status of Genomics, and especially new genomics technologies, should also be debated as it may have a role to play in agroecological transitions (Agence nationale de la recherche [ANR], 2020).

The analysis of the corpus and the participative workshop in Rome, sparked many constructive debates with regards to the nature, form and articulation of drivers. Discussions led to the conclusion that **data and new metrics are still needed to promote agroecology, especially if blind spots enter the game**. However, quantitative methods alone are far from being sufficient, especially since agroecology is context-specific. **Focusing on the quantitative impels us towards studying trends and not ruptures.** Consequently, it is essential that the **qualitative and quantitative approaches are articulated. This would lead to new drivers, new ways of their being assembled and creation of a vision of future states for new possible futures.** We are invited not only to **think in terms of drivers but above all in terms of the mechanisms and logic that underlie the functioning of the systems, by interrogating the opinions and paradigms held among actors**. A call is made for **further transdisciplinary work**, with adapted forms of drivers that will better convince people of the need for an agroecological transition.

The need for more and new metrics

There is a common understanding that promoting agroecology requires **even more data-based evidence of the benefits for socioecosystems**. It is crucial to evaluate the orders of magnitude of future evolutions. The **question of yields** is central, and there is no clear consensus on this topic. Many models use yields from organic agriculture as an approximation. The main difficulty being that agroecology covers very different context-specific practices that are difficult to generalize. The results also depend on the **units chosen**: analysing tonnes or calories per hectare gives us contrasting yields, since crop rotation is key. With regards to **global health benefits**, more research is required to quantify them for agrobiodiversity and human health.

As we have shown, other dimensions are often neglected or lacking in models, especially because data have not yet been consolidated or economic models developed:

- **Farm structure typology, especially the size of farms and individual versus collective farming**
- **Level of adoption of agroecological practices and the effects of training**
- **Employment and division of labour, labour intensity**
- **Capital intensity**
- **Technology intensity (including big data generation and use, and new techniques in biotechnologies)**
- **Inequality in revenues and access to capital**
- **Economic viability and farms' capital structure**
- **Access to land/land tenure**
- **Access to local training**
- **Funds for research and development (R&D)**
- **Capital flows in international markets**
- **Balance of payments (see the literature of post-Keynesian economics)**
- **Food prices**
- **Processing and storage capacity**
- **Market concentration**
- **Emissions associated to transportation**

How can we measure these "blind-spotted" variables? It depends on the reasons behind the apparent lack of data. It may either be from a lack of research (especially for context-specific variables), meaning that **more research funds need to be directed towards measuring blind-spotted variables**. It may also arise from the dispersion of data, which can be overcome if **research communities are better interconnected**. Finally, deficient data may be because of a lack of access to data, suggesting we should **advocate for improved and open access**.

Reconsidering the monopoly of metrics

A pitfall lies in relying on quantitative variables alone to guide decision-makers. This may feed a certain **tyranny of numbers**, where there can be poor control over the **institutional or political uses** of the results without consideration being given to the limits and hypothesis behind the figures. The richness of the analysis and the complexity of scenarios may be oversimplified. Power may be further **concentrated** in the hands of those of implementers or institutions that own the data. Last, **this monopoly of metrics can explain partly the existence of blind spots when the data is not available. All drivers are not commensurable, even if proxies are used.**

In particular, it is questionable how to better **consider social and institutional dimensions**. For example those drivers related to: the **social context and structure; how farms are transmitted by inheritance; how production systems are organized; how power and added-value are distributed; how values and social norms such as social justice evolve; how law and regulations (national and international) are designed; how information circulates**.

These drivers are key to enriching the narratives about agroecology. Drivers **shape the future of farms and peasantry, but also the "missing middle", which is the part of the system between farmers and consumers, which needs to be analysed at the meso level**, and is poorly considered in foresight studies. As the plurality of knowledge is unique to agroecology, a greater effort should be made to **include local knowledge and training for farmers and students** in the foresights relative to the transformation of food systems. The **futures of mobility and transportation** should also be considered to ensure proximity and confidence between producers and consumers through promotion of fair and short distribution networks. Moreover, one of the principles of agroecology is the **re-embedding of food systems in local economies**.

Articulation between quantitative and qualitative approaches is, therefore, an avenue for research. How can we model in a new way? Can modelling be based on interviews or other social science methods? These questions are even more relevant when the scales of analysis are **changed**. An interesting example is to adapt aggregated national models, for which data is easier to collect, to territories for agroecology. This scale requires us to consider not only the systemic effects at the scale of the landscape, but also socioeconomic local dynamics. This can be accomplished in different ways, either by adapting the modelling tool (by simply changing the parameters, or including new variables, or even changing the mathematical relationships), or starting from qualitative scenarios and using models to illustrate them. It would also be possible to mix both approaches by building a morphological table with quantitative and qualitative variables.

The question of assumptions: influential variables and future states

Once the drivers of the system are chosen, the next step in the process is to analyse their mutual influence, by interrogating their initial causes and relationships. After this the future states of each variable need to be fixed to build scenarios. Understanding the past well and analysing past trends is required. If data is used, when possible, the measure of errors and uncertainties should be indicated. However, historical analysis may have the drawback of encouraging hypotheses in the continuity of the present.

Foresight processes for agroecology call for more radical versions of the future: understanding the past and going beyond trends, imagining destabilizing factors, focusing on structures and logics rather than metrics, imagining new assumptions. In order to enlarge and enrich scenarios about the transformation of food systems by agroecology, it would be useful to transform all the principles of agroecology as possible assumptions of the drivers of food systems.

Care should be taken during foresight activities to avoid remaining with ongoing concepts, preconceived ideas, general assumptions or drivers for which data is available. Participants should not overlook inertia and rapid change. Note that foresight actives require freedom of thinking and expression, debates and open minds.

Drivers to convince and communicate

The wording and assumptions about drivers need to be thought out and communication be considered as a step. Communication should have been anticipated, the audience should understand this clearly, be it formed of communities and/or policymakers. For example, the language used should target the particular audience. **The formulation should take**

into account social concepts and values. Appealing stories should be written, ones that are concrete and engage the emotions. For example, narratives should be about present ideal meals instead of tonnes or calories produced.

The need for transdisciplinary work

The discussion initiated in this section encourages **transdisciplinary work.** Being able to engage in interdisciplinary work is a first step, especially when it comes to the blind spot issues. The **knowledge of multiple disciplines and their articulation is determinant** in shedding light on the different dimensions and parts of the food system. The process, however, requires us to go beyond **because it is essential to bring about a change in attitude. In agroecology, the drivers are systemic and multileveled, they cover a wide-range of actors for whom synergies are required**. What is important for one actor is not necessarily the same for another.

When talking to an actor, it is essential that we target what counts for them, and adapt the conception and language to their understanding. **An important parameter when deciding on drivers is to aim for multiscale participation, rather than metrics.** This decision-making process would then be context-specific, as well as participant-specific. In this case, the choice of variables is not only justified by the objectives of the process, but also by the groups' involvement. Variables are at the crossroad of aims and actors, for the participants and for the audience.

BOX 6 PHASE 3: RECOMMENDATIONS RELATIVE TO DRIVERS AND ASSUMPTIONS FOR FORESIGHT AND AGROECOLOGY COMMUNITIES

- Drivers (or driving forces) are factors that cause change, that affect or shape the future. A retrospective analysis of the question addressed helps us to identify drivers. In order to identify new drivers, we must identify the blind spots revealed in past foresight processes and imagine possible future disruptions, weak signals and wild cards, i.e. deep disruptions to existing trends and established systems.
- It is important to recognize the importance of subjectivity and political viewpoints in the choice of drivers as well as the fact that some blind spots may be because of lack of data. A fine balance always needs to be achieved between avoiding significant blind spots in the analysis and having too many drivers, which can lead to unreadable results.
- To formulate assumptions:
  - **Work in a transdisciplinary manner and with different actors.** Change your opinion and interrogate paradigms among actors. Do not be afraid of radical opinions.
  - **Base assumptions on the principles of agroecology and be creative so as to formulate different assumptions concerning agroecology.**
  - **Recognize that all drivers and assumptions are not commensurable, even if proxies are used.** Formulate qualitative and quantitative assumptions.
  - Anticipate the writing of narrative scenarios by appealing to the emotions and being concrete.
- **Recognize that all drivers and assumptions are not commensurable, even if proxies are used.** Formulate qualitative and quantitative assumptions. Relying only on quantitative variables to guide decision-makers is a pitfall. It feeds a certain **tyranny of numbers**, with poor control on the **institutional or political uses** of the results without considering the limits and hypothesis behind the figures. It can oversimplify the richness of the analysis and the complexity of scenarios. It can further create a **concentration of power** in the hands of those among implementers or institutions owning the data.
- **Develop new metrics, and obtain better quality and more data for assumptions about agroecology.** Introducing agroecology into foresight processes requires sufficient data to evaluate the orders of magnitude of future changes. The question of yields is central, but fewer data exist for crop and livestock yields, used in agroecological approaches, than for product yields that are used in conventional agricultural systems (Tixier, 2020). Moreover, agroecology covers very different context-specific practices, therefore it is difficult to generalize. To obtain more and better-quality data, advocate for connections between research communities, improved open access and sufficient research funds.

Source: Tixier, P. 2020. Modelling in agroecology: from simple to complex models, and vice versa. In: Modelling in agroecology: from simple to complex models, and vice versa. CIRAD, INRAE, INRIA. Montpellier, France, CIRAD, 2 p. International Crop Modelling Symposium (iCROPM 2020). & Authors' own elaboration.

4.4 PHASE 4: BUILDING SCENARIOS AND RUNNING THE MODELS

The foresight methodologies used in the corpus were presented in Section 4.1.4. In this section, we analyse the number of scenarios produced in foresight processes, as well as the linkages between the number of scenarios and the method used to build scenarios.

4.4.1 Agroecological scenarios

A large variety of scenario sets were presented in the corpus. Some had only one scenario where agroecological assumptions were stated, while for others there were several (see Table 7).

The scenarios are described as follows:

Two contrasting scenarios: *TYFA, Long Food Movement, Agrimonde, AgroEco2050, Treshhold21-iSDG, Burkina – CLI, CAPRI*, and *Afterres*.

A first scenario is based on ongoing trends (i.e. business as usual or status quo), while the second scenario describes food system transition with agroecology (e.g. "civil society as unusual"). The *Afterres* scenario contains two variants: Health, Food, Biodiversity; and Resilience and Production.

Table 7. Foresight activities, number of scenarios and anticipatory methods

Foresight activities	Number of scenarios	Number of agroecology scenarios	Anticipatory method
5 – Ten Years For Agroecology	2	1	Modelling
7 – CAPRI	2	1	Modelling
8 – Afterres	2	1 + 2 variants	Modelling
11 – Threshold21-iSDG model	2	1	Modelling
1 – Long-Food Movement	2	1	Narratives
3 – Agrimonde	2	1	Interactions between modelling & narratives
3a – AgroEco2050 India	2	1	Interactions between modelling & narratives
13 – Burkina-CLI	2	1	Interactions between modelling & narratives
2 - Small-scale agriculture	3	1	Narratives
9 – SSP-UK	4	1	Narratives then modelling (trends)
10 - LAC Agri-futures	4	2	Narratives
6 – UNISECO	4	3	Interactions between modelling & narratives
4 - Agrimonde-Terra	5	4	Narratives and then modelling
4a – Agrimonde-Terra Tunisie	5	1	Narratives
12 – FAIR Sahel / – Fatick	8	5	Narratives
12a – Niayes 2040	9	4	Narratives then modelling

Source: Authors' own elaboration.

Three scenarios include one with transformation towards sustainability. In *"Small-scale agriculture"*, one is a business as usual situation. The second describes transformation ("Towards sustainability"). The third describes a situation that is worse than business as usual (here "Stratified societies").

Four or more scenarios include one or more scenarios involving agroecology. Such scenarios can be built around two axes, or result from the coherent combination of assumptions based on morphological analysis.

The following foresights have four or more scenarios: *SSP-UK, LAC-Agri-Futures, UNISECO* (see **Figure 12**); *Agrimonde-Terra* (see **Figure 13**) and *Agrimonde-Terra Tunisie*; *FAIR Sahel / Fatick* and *Niayes 2040*. Except for SSP-UK, all contain at least two scenarios with strong agroecological assumptions.

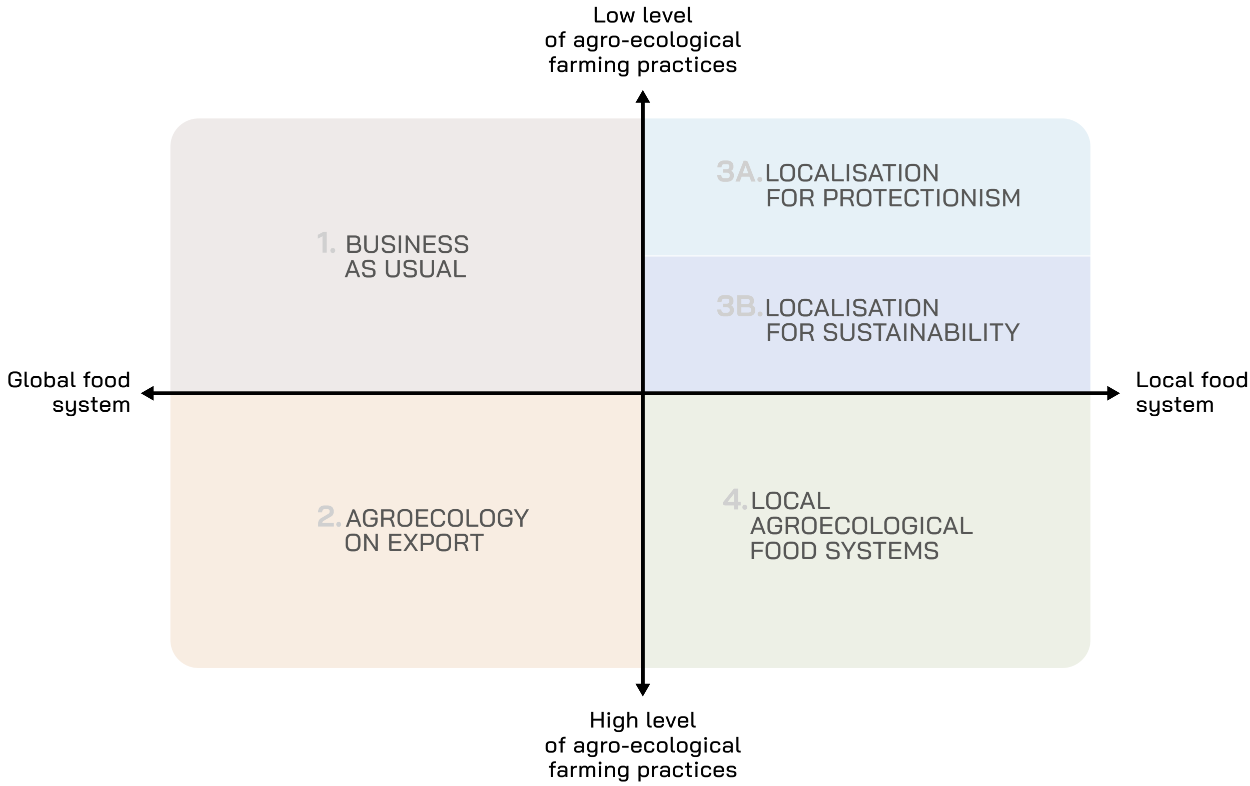
In *LAC-Agri-futures*, two scenarios consider transformation with agroecology. In the scenario "Back to rural", there is an increase in peasants' "radical" or "political" agroecological approach, which is strong in the region, with a turn towards short circuits, low-input production models, forced energy transition and small to medium-scale farms depending on local resources. The scenario "Design pathway" assumes that agroecology widely permeates technical and institutional spaces, is widely disseminated and has been adopted by different actors, who have adapted it to different scales and modalities. Strategic alliances are strengthened between countries of the Latin American region.

In *UNISECO*, two scenarios have a high level of agroecological practices. In the scenario "Local agroecological food systems", there is the same diffusion rate of agroecology for all crops and livestock production systems, i.e. 50 percent of all wheat; 50 percent of all pork. However total absolute figures for these changes follow a change in diet. In the scenario "Agroecology on export", agroecology practices only expand for certain export-oriented products, such as fruits, vegetables and nuts.

In Agrimonde-Terra, four out of five scenarios deal with the transformation of food systems with agroecology and/or sustainable intensification of practices. Combined with other assumptions, scenarios are called: "Land use for regional food systems", with the following assumptions: regional diversity of diets and food systems; rural areas have been integrated into urban networks through value chains; cooperatives emphasize quality; agroecology livestock is raised in synergy with agriculture or urbanization, and agroecology and sustainable intensification. "Land use for multi-active and mobile households", contains the same assumptions added to multilocal and multiactive households in rural–urban archipelagos. "Land use for food quality and healthy nutrition" presents assumptions about healthy diets based on food diversity. "Land as commons for rural communities in a fragmented world" adopts the following assumption: farms produce goods and services for the surrounding community (see **Figure 13**). With similar practices at the level of the farm or the agrosystems, the food system is different because of different assumptions on the relationships between urban and rural areas, on food diets, and on the global context.

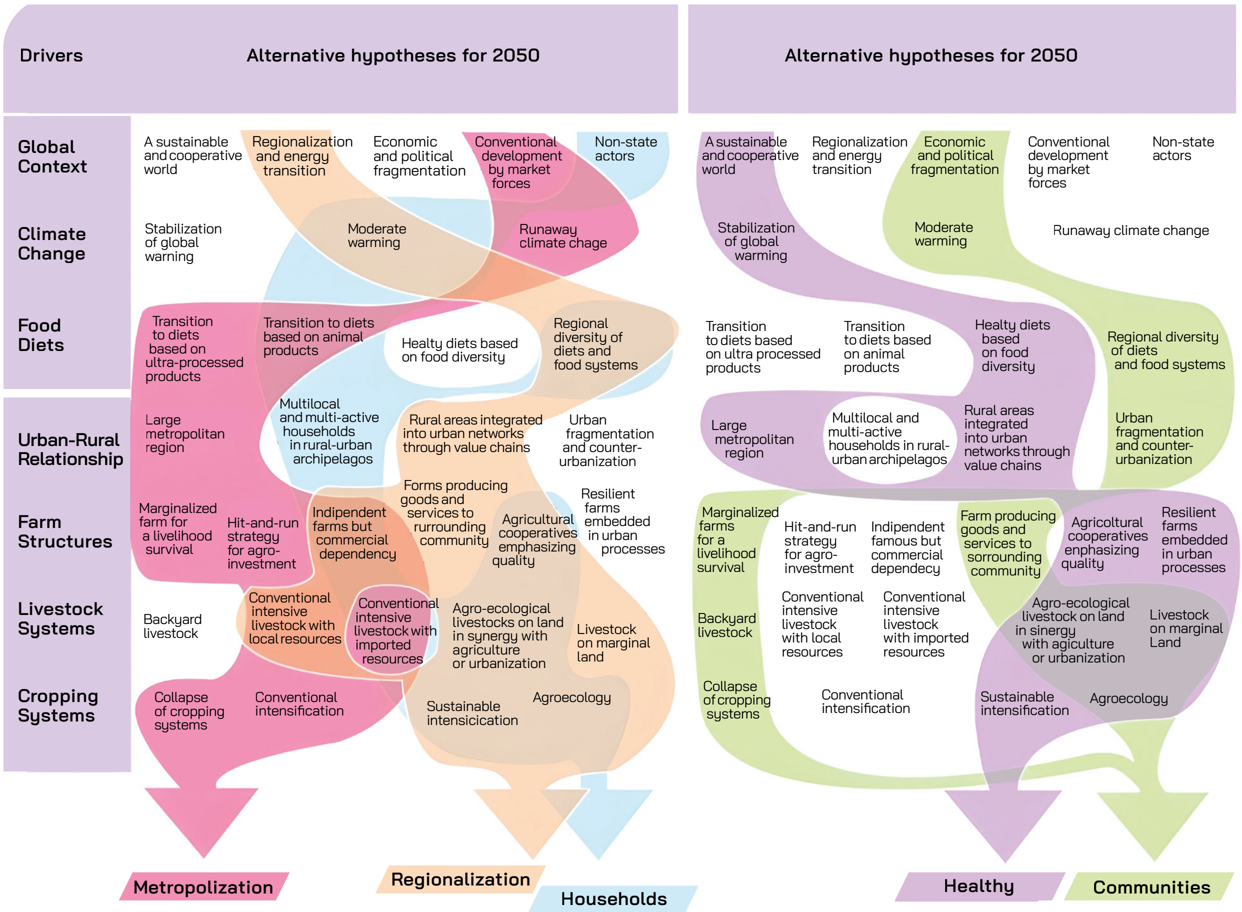
In *FAIR Sahel / Fatick*, five scenarios out of eight employ agroecology. In "Fatick Autonome", an agroecological, healthy and sustainable agriculture integrates livestock and forestry to fertilize the soil organically. Appropriate equipment is employed to reduce the drudgery of work and improve productivity. In *"Nataange"*, the breeding and agricultural systems respect the principles of agroecology. In *"Made in Fatick"*, the agricultural production systems favour agroecology and there are diversified family farms that favour cooperatives; the presence of many animals maintains soil fertility; crop rotation and use of crop residues is encouraged. In *"Le royaume et ses divinités"*, the power is in the hand of a king that values an agroecological vision and self-centred development, favours the autonomy of communities, and established strict rules regarding energy, security of goods and communities, access to and use of natural resources and land. In *"L'autarcie"*, farms are organized as collectives, extensively use agroecological practices, and exclusively employ organic inputs and manure.

Figure 12. UNISECO: Four scenarios built around two axes, one is the level of agroecological farming practices



Source: Kalt, G., Mayer, A., Haberl, H., Kaufmann, L., Lauk, C., Matej, S., Elin Röös, E., Michaela C. Theurl, M.C. & Karl-Heinz Erb, K-H. 2021. Exploring the option space for land system futures at regional to global scales: The diagnostic agro-food, land use and greenhouse gas emission model BioBaM-GHG 2.0. *Ecological Modelling*, Vol. 459, p. 109729, Nov. 2021.

Figure 13. Agrimonde-Terra: Five scenarios were built with a morphological table



Source: Le Mouël, C., de Lattre-Gasquet, M. & Mora, O. 2018. *Land use and food security in 2050: a narrow road. Agrimonde-Terra*. Edition Quae.

4.4.2 Lessons derived from agroecology

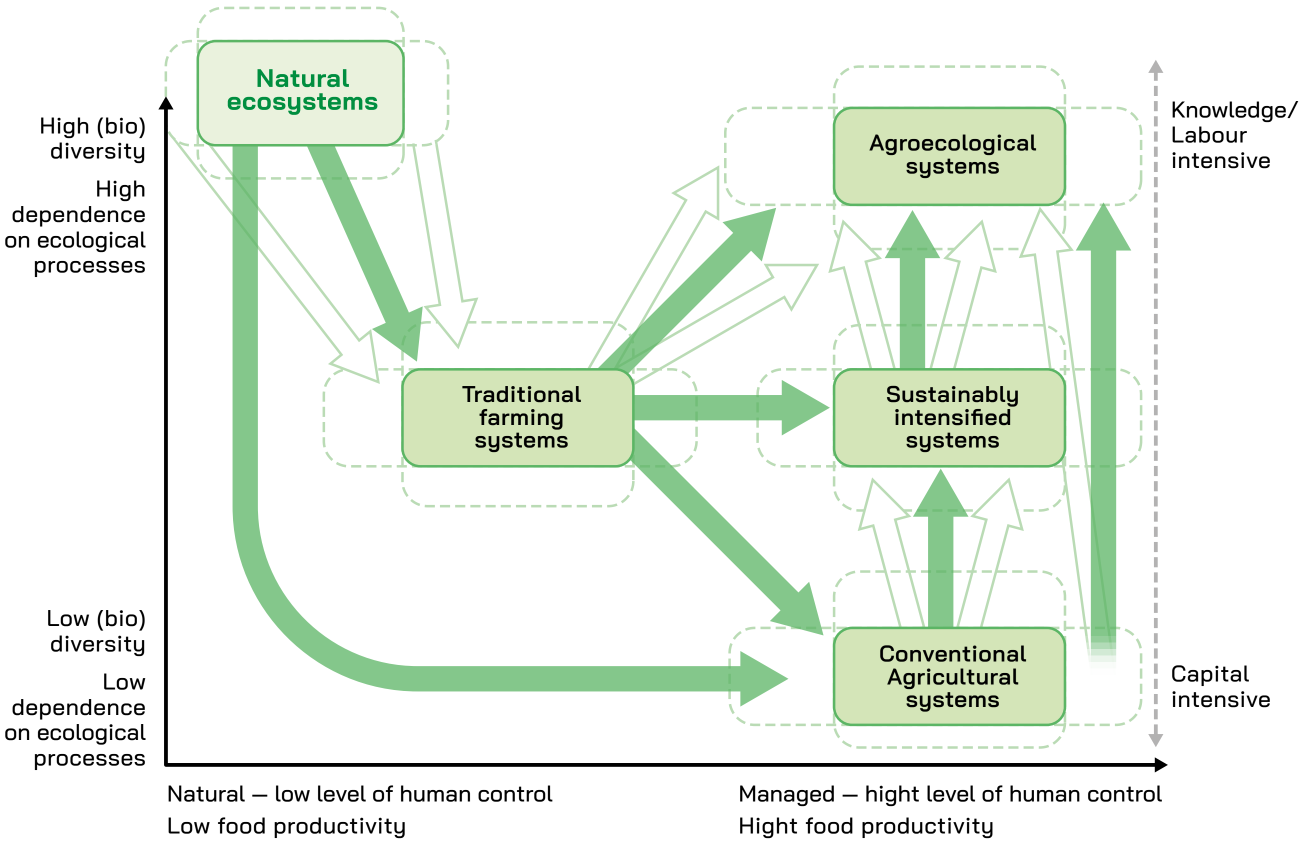
What do the scenarios illustrating agroecology tell us about the meaning of "agroecology"? Is there only one pathway to the transformation of food systems through agroecology, or are there several pathways? Is there one or several forms of agroecology?

UNISECO, LAC-Agri-futures, Agrimonde-Terra and *Fair Sahel / Fatick* demonstrate that **there are several possible ways food systems can be transformed by agroecology**, even if narrowly defined and only related to agricultural practices. The assumption about agroecology can be combined with assumptions related to farm structures, food diets, connection between urban and rural areas and contracts, and the political and economic contexts.

These transformations could be situated on an agroecological spectrum, either by evaluating whether the ideal practices of driving actors are aligned with the principles of agroecology, and/or by evaluating to what extent the practices implemented by the defined system fulfil these agroecological principles and perform well (Dumont *et al.*, 2021). Another possibility is to look at the transformative paradigm of agroecology: is it incremental and does it only address levels 1 and 2 of Gliessman's framework and a few of HLPE's principles (recycling, input reduction, soil and animal health, biodiversity, economic diversification, synergy), or is it transformative and addresses levels 3 to 5 and more HLPE's principles (social values and diets, fairness, connectivity, land and natural resources governance, co-creation of knowledge, participation)?

Future scenarios could explore more trajectories as multiple transition pathways already exist for agricultural systems (see Figure 14). There are even more for food systems that go far beyond production (agricultural systems) and include processing, retailing, storing, disposing, as well as consuming, socioeconomic and environmental systems.

Figure 14. Multiple transition pathways for agricultural systems



Source: p. 64 in: HLPE, 2019. Agroecological and other innovative approaches for sustainable agriculture and food systems that enhance food security and nutrition. A report by the High-Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security, Rome. HLPE Report #14.

4.4.3 The use of models in scenarios

The analysis of the linkages between the number of scenarios with agroecology, and the method used, shows that when only modelling is used, two scenarios (agroecology and business as usual) are often proposed (see Table 7). When there are narratives, the number of scenarios increases, including scenarios with agroecology. Narratives seem to open up a broader possibility of futures with agroecology than with modelling. Four types of models are employed in the corpus:

- **Biophysical balance:** Agribiom, implemented in *AgroEco2050*, is a world food balance model; *Agrimonde-Terra* and *TYFA* have employed biomass balance models. *Afterres* has used *Modélisation Systémique de l'Usage des Terres*. BioBaM-GHG was used by UNISECO to evaluate the feasibility of agroecology and associated the GHG emissions of large numbers of agrofood systems and land-use scenarios at various scales. A mass and nutrient-flow model, SOLm, was also used, which captures the global food system at the level of geographic units, linking production, consumption and trade, with the aim of deriving and analysing the food system's input use, outputs and impacts on sustainability.

- **Economic:** *CAPRI* is a global, comparative static, partial equilibrium model. The Agribiom Lewisian submodel in *AgroEco2050* explores the economic implications of contrasted futures in terms of employment and income inequality. *Burkina-CLI* employs the model Cikɛda, which simulates the technical–economic operations of a farm over the course of one year. Seven modules represent the interactions between a farm's crop and livestock systems and balance sheets showing resource supply and demand and the economic performance of crop–livestock activities.

- **System dynamics:** Employed by *Threshold21-iSDG*, this model integrates economic, social and environmental factors. Important complex elements are included such as feedback relationships, nonlinearity and time lags.

- **Spatial:** A spatial model of land and water use was employed in *Niayes 2040*. The different scenarios were simulated and compared for the level of the groundwater table and other variables.

Assumptions about models are often made concerning the shares of products for food diets; yields per hectare and per crop; impact of climate change on yields; cropping intensity ratios; levels of agricultural inputs; animal production shares; levels of biomass used for energy; GDP and its impact on research and development (R&D) levels; and use of food/feed. Constraints can be placed on the different types of land use and on imports and exports (see Section 4.3). All models do not provide the same output variables. The following are found in the corpus, in order of occurrence:

- Levels of crops and animal production as well as non-food production, for example, in *TYFA*, *Agrimonde*, *Agrimonde-Terra*. In *Burkina-CLI*, outputs are about cereal balance, fodder balance, cereals and cotton sold.
- Imports and exports of certain products.
- Areas of land uses. For example, in *TYFA*, *Agrimonde*, *Agrimonde-Terra*.
- Nitrogen or mineral fertilizer balance. For example, in *TYFA* and *Burkina-CLI*.
- GHG emissions. For example, in *TYFA* and *Afterres*.
- Land productivity or yield change. For example, in *AgroEco2050*.
- Revenues, or labour productivity. For example, in *AgroEco2050* and *Burkina-CLI*.
- Level of water table. For example, in *Niayes 2040*.
- Ecosystem services.
- Food prices.
- Adoption of technologies.
- Inequality. For example, in *AgroEco2050*.
- Ammoniac emissions. For example, in *Afterres*.
- Agroecological infrastructures. For example, in *Afterres*.

BOX 7

PHASE 4: RECOMMENDATIONS RELATIVE TO BUILDING THE SCENARIOS AND MODELS FOR FORESIGHT AND AGROECOLOGY COMMUNITIES

- **Be proactive and don't be afraid of building futures that seem unimaginable today. There is a large array of constantly changing possible futures, some disappear as others emerge, but our ability to imagine what could be is limited.**
- **Enlarge the possible futures of food systems through agroecology by developing several scenarios with agroecological principles and create powerful and imaginative representations of the future.** As agroecology is a science, a set of practices and a social movement, there are multiple pathways to agroecological transitions for more sustainable food systems. These depend on the starting points, on the context and on engagement with markets. A diversity of participants should contribute to opening up paths to transformation. Several projects described in the corpus show there is a wide-range of agroecological practices, of redesign of agroecosystems, of connections between producers and consumers, changes in diets, changes in farms' organizations and aims, and therefore agroecology may have several possible futures.
- **Understand the advantages and drawbacks of the various sets of scenarios:**
  - **One scenario focused on agroecology will be normative.** It will provide tools and keys to understanding a situation, transforming it and facilitating decision-making by comparing to the initial situation. There is, however, a risk of decision-making in silo, which will not open up many possibilities for transition and transformation.
  - **Two scenarios (a scenario with business as usual/industrial food system, and a scenario on the transformation of food systems through agroecology). These scenarios facilitate advocacy for agroecology, structure debates and shed light on implications of business as usual and agroecology by stressing the contrast between the two situations.** Scenarios can be presented as a narrative or provide quantified implications for farming and well-being (employment, incomes, food, etc.). This practice permits the indication of "big switch" factors. Results are easy to understand, but tend to polarize the debate.
  - **Three scenarios, including only one scenario that describes the transformation of food systems with agroecology, does not help as much when compared to the set of two contrasted scenarios.**
  - **Four or more exploratory scenarios describing agroecology open up the range of possible transformations and help identify further triggers for change, even if these scenarios are more challenging to communicate.**
- **Write appealing stories to engage the emotions and be concrete.** Create powerful and imaginative representations of the futures of food systems with agroecology, because to be human is to live with stories. The transformation of food systems through agroecology calls for major changes that are difficult for us to imagine today.
- **Combine narratives and modelling.** The combination of qualitative and quantitative methods will help in the understanding of changes and be more convincing than using only stories or numbers. The results of modelling can contribute to disrupting present perceptions about agroecology as well as dominant industrial systems, and indicating trade-offs. Modelling will provide estimations of availability of food products (in calories); areas of land use; GHG emissions in tonnes equivalent CO_2; nitrogen balance; carbon sequestration; quantities of agricultural commodities imported and exported, etc.
- **Question the classic agroeconomic models and develop new models for agroecology.** First, current models use aggregated data which is available at the world or the regional levels, but lacks the understanding of the local level that is key to agroecology. Second, the partial equilibrium models used are flexible, but concentrate on the agricultural sector and do not consider other sectors of the economy (Nehrey, Kaminskyi and Komar, 2019). Third, the dominant approach is based on comparisons of annual

crop-by-crop output per hectare. This is not the situation in tropical and subtropical countries where multicropping and a combination of local crops and livestock is common. Modelling agroecological practices implies considering a network of interactions between rich varieties of plants, animals, trees, pests and diseases, water and nutrients, with heterogeneous spatial and temporal organizations. Last, the transformation to sustainability, especially with a strong perspective, implies using indicators that capture economic, environmental, and social outcomes from the implementation of agroecology. New models are called for that incorporate these specificities into their structural mathematical assumptions. For example, stock-flow consistent models could be implemented to test the financial dimensions of the transformations. Linkages with models for sustainable supply chain management should also be considered to test principles like recycling, connectivity and synergies.

Source: Nehrey, M., Kaminskyi, A. & Komar, M. 2019. Agro-economic models: a review and directions for research. Periodicals of Engineering and Natural Sciences, 7(2), 702-711 and authors' own elaboration.

4.5 PHASE 5: LEARNING FROM THE SCENARIOS

Scenarios do not describe what will happen but what could happen. Their value lies in shedding light on the path to take, in teasing out the heavy trends, the major uncertainties, the main risks of breakdowns and the future challenges.

All the foresight activities in the corpus shed light on the fact that a future with "conventional"/"input-intensive"/"industrial" food systems is not desirable. For example, in *Long Food Movement*, the "Agribusiness as usual?" scenario highlights the dangers of the union of big agrifood companies and data platforms; agribusiness concentrations; price spikes; food shortages; environmental breakdown, etc. In *Agrimonde-Terra*, the scenario "Land use driven by metropolization" is unsustainable from both the viewpoint of public health and preservation of resources.

In the scenarios involving agroecology, diverse transformations take place in food systems, e.g. healthier diets, better attainment of SDGs, greater biodiversity, higher farm employment and revenues, etc. However, there are always trade-offs (e.g. the use of land to produce biomass for energy, decreased forest areas, the need for nitrogen, net import dependence) and questions remain about socioeconomic and political implications. Agroecology does not solve all problems.

In Afterres 2050:

> *"the overall energy consumption of agricultural production is reduced by 40 percent, thanks to the changes in systems and in practices (fuel for ploughing, fertilizers), and to technical improvements (low consumption greenhouses, economical irrigation, tractor engines)".*

The quantity of wood used for construction and irrigation is reduced.

The *Agrimonde-Terra* scenarios indicate that limiting the expansion of agricultural land requires increased performance of agriculture in some regions, and that mitigating climate change requires the production of renewable energy and the maintenance of world forest cover.

Threshold-iSDG states that:

> *"… agroecology has the potential to strongly support the achievement of the 2030 Agenda. Therefore, its implementation must be strengthened. The transformation towards agroecology must be addressed sooner rather than later. The significant delays between policy and effect, especially for intervention areas such as education, reforestation and land or soil recovery, highlight the importance of quick action. In addition, the inherent feedback loops reinforce positive developments over time, so*

that improvement is greater the sooner these dynamics are activated".

In *UNISECO*, a range of feasible scenarios involving agroecology provide environmental benefits if agricultural systems adopt innovations from the plot to the food-systems level.

The *TYFA* scenario is based on the widespread adoption of agroecology in Europe, the phasing-out of the importation of vegetable protein and the adoption of healthier diets by 2050. Despite an induced 35 percent drop in production, compared to 2010, it is possible to provide healthy food for Europeans while maintaining export capacity; reduce Europe's global food footprint; reduce GHG emissions from the agricultural sector by 40 percent to regain biodiversity and conserve natural resources. The agroecological scenario presented by *AgroEco2050* ensures greater food security, in terms of both quantity and quality. This scenario also guarantees almost full employment for 20 to 64 year-olds by 2050, while reducing the income gap in relation to nonfarmers. There will still be rice exports, although fewer.

BOX 8

PHASE 5: RECOMMENDATIONS RELATIVE TO LESSONS LEARNED FROM SCENARIOS FOR FORESIGHT AND AGROECOLOGY COMMUNITIES

- **Draw lessons from the comparison of scenarios.** Compare the results of modelling scenarios among themselves or to the initial situation (baseline). Understanding the results of modelling implies that the model is transparent, clearly presenting the strengths and limitations as well as sources and levels of uncertainty. But the comparison of results between foresight processes is often difficult because inputs differ.
- **Draw lessons from the narratives as well as from the modelling results.** Develop messages that are appropriate for all types of actors and not exclusively for policymakers.
- **Be precise about the negative impacts of input-intensive and industrial food systems.** Although industrial food systems have contributed to feeding the world, over the last decades these systems have had increasingly negative impacts on food; diets and health; employment; farmers' revenues; inequality; soil quality; biodiversity; GHG emissions and climate. Scenarios tend to show that these impacts will become worse in the future.
- **Be specific about what is learned from the scenarios with agroecology: the positive aspects and the tensions.** Refer to the ten FAO elements or the thirteen HLPE principles of agroecology.
- **Clearly express the strengths and weaknesses of the methods and models used.** Their capacities and limitations should be carefully evaluated and communicated during assessment and decision-making processes. Sources and levels of uncertainty should also be evaluated and communicated. Uncertainty, associated with models, is often poorly evaluated and reported in published studies, which may lead to serious misconceptions – both overly optimistic and overly pessimistic – regarding the level of confidence with which results can be employed.

Source: Authors' own elaboration.

4.6 PHASE 6: HIGHLIGHTING OPTIONS FOR ACTION

It is up to decision-makers to make their choices. At the end of a foresight process, however, several options for action should be highlighted to help decision-making. All foresight activities of the corpus did not arrive at this phase, the remaining studies propose the following options.

Agrimonde looks at **scenario-based insights** involving food behaviours, options for ecological intensification and regulations for trade and sustainable agriculture. **Food and nutritional policies** are proposed to change diets; the introduction of strong public policies with multiple objectives; **trade regulations**; development of local **opportunities** for wealth creation and **investments** in developing countries' agriculture.

The final chapter of *Agrimonde-Terra* presents options for public policies. The publication highlights that:

> *"… no one-size-fits-all solutions. Each region and each country should find its own pathway related to its past situation and ongoing trends. It needs to identify its own policies and its leverage points and their feedback loops to change pathways. However, there are "no-regret" objectives, i.e. objectives that should be pursued whatever the scenario because of the importance of the challenge in order to avoid catastrophes".*

Six objectives are proposed for policies: building **synergetic governance** for land use and food security at different spatial scales; developing **coherent and coordinated policies** on land use and food security; promoting changes on **both the demand and supply sides** for transition towards healthy diets and reduced waste and losses; improving the economic, environmental and social **performance** of cropping and livestock systems or redesigning them; **rethinking the organization of trade; securing access to land** for all types of farming structures and paying attention to rural development.

Afterres proposes four **levers for change**: food diets (less overconsumption and waste; fewer animal proteins and more organic food); agricultural systems and practices (more diversity, less synthetic fertilizers and pesticides, a less vulnerable agriculture); imports and exports with the rest of the world; preservation of available areas. As the process continues, Solagro and IDDRI organized *"l'université Afterres 2050"* in 2021 to discuss the use of the foresight process in the creation of public policies and means for territories to engage in transitions.

A Policy Brief, prepared by *TYFA* and published in 2018: *Reaching the Farm-to-Fork objectives and beyond: Impacts of an agroecological Europe on land use, trade and global food security*, presents the implications of the scenario and policy proposals to spur transition. Proposals include supporting dietary transition towards healthier and less calorie-dense diets with fewer animal and ultra-processed food products; maintaining EU price and non-price competitiveness in domestic and foreign markets through agronomic research; improving coordination between actors and ensuring market segmentation for EU "ecologically intensive" agricultural commodities; and amending current market conditions to improve EU protein autonomy through the reintegration of legumes in rotations.

Long Food Movement identifies **four pathways and 13 opportunities**. The four pathways are: rooting food systems in diversity, agroecology and human rights; transforming governance structures; shifting financial flows; and rethinking the modalities of collaboration with civil society organizations.

General recommendations were made by *UNISECO* on **social rights** (e.g. farmers applying new practices and standards; reducing dependency on inorganic inputs; ensuring no actors are left behind in just transitions to new practices and structuring farming and food systems). Recommendations on **education and training** include incorporating the principles and practices of agroecology in school curricula; continuing professional development, and citizen focused learning; increasing the capacity of local actors to create agroecological networks, and cooperating with schools through public learning and procurement programmes. Recommendations for **science** include encouraging and operationalizing a culture of Open Science to support agroecological farming systems; motivating and empowering all actors to develop shared visions for local areas; monitoring and informing through citizen science. Recommendations are also made for **financial support** for agroecological farm practices that benefit human and environmental health.

BOX 9

PHASE 6: RECOMMENDATIONS RELATIVE TO OPTIONS FOR ACTION FOR FORESIGHT AND AGROECOLOGY COMMUNITIES

- **Remind decision-makers**, i.e. all stakeholders and not only policymakers, **that "When it is urgent, it is already too late".**
- **Present insights in the societal context**, i.e. the stakeholders involved and their culture, opinions, hopes and fears. This is very important for agroecology. Recognize the diversity of cultures among the different decision-makers.
- **Present insights on policy issues in a holistic and transparent manner.** Develop backcasting and participative roadmaps to anticipate future developments and avoid unwanted futures. Provide "no regret" recommendations as well as reflections about the impacts potential policies may have on actors, as well as how they may interfere in policy areas.
- **Incite interdisciplinary work with political scientists when working on options for policies.** Policies should be driven not only by evidence but also by ethics.
- **Insist on what is important, on emerging trends and on blind spots, and on leverages and linkages between policies to avoid "silos".** Policymakers tend to insist on "evidence-based policies" that tend to perpetuate *business as usual* scenarios.

Source: Authors' own elaboration.

4.7 PHASE 7: COMMUNICATING AND DEBATING THE OUTCOMES OF THE FORESIGHT PROCESS

The modes of communication employed in the foresight processes in the literature are similar. The *Afterres* 2050 scenario report was published in 2016. The Afterres website (Solagro, 2024) **presents ongoing activities**, such as the **"plate game"**, which is an animation tool to guide territories in their reflections on desirable diets in 2050. The "Biodiversity component" of *Afterres* was published in November 2022, and workshops were organized for its presentation as well as the 12 action levers for more than 400 participants.

The *TYFA* scenario was published in 2018. The website "Ten Years for Agroecology in Europe" (IDDRI, n.d.) shows the ongoing activities since then. In November 2021, a report was published that details an analysis of the United Kingdom of Great Britain and Northern Ireland's (UK) food system under an agroecological future. All the results are shown on *UNISECO's* website, the "Agro-Ecological Knowledge Hub". (UNISECO, n.d.) A **set of methodological guidance briefs** is available on selected key methods and approaches for assessing and co-constructing strategies for agroecological transitions in a transdisciplinary setting. *Agrimonde* and *Agrimonde-Terra* led to **books** and many **articles** and **conferences**, which are presented on CIRAD and National Research Institute for Agriculture, Food and Environment (INRAE) websites. **Long Food Movement** led to a report that was discussed in many instances.

What are the outcomes of a foresight process? What is considered a result? First, the process in itself is a result when it creates a **working group dynamic** among participants and implementers, as well as **individual and collective learning**. This dynamic will be crucial for the **dissemination** of what was effectively produced by the group and its impacts. Second, **production can take different forms; usually as scenarios for the future, be they desirable or not**.

These scenarios can be presented in the form of **narratives**, in written texts or drawings. They can be the result of a model that will propose **future trajectories for variables**. The result may also be in the form of data collected from experts that share past and present values for variables and propose **trends or disruptive future paths**. The result may also be an **answer to simple binary questions**, such as "is agroecology possible?". Various **media** can be chosen to disseminate such results, but usually it takes the form of a report. However other more original formats are possible such as websites, videos, novels, podcasts, art exhibitions, etc. **The report, or any other final product, needs to be disseminated, communicated and debated in different arenas**.

Linking aims and communication

Fulfilling the ultimate aims of foresight processes (see Section 3.1) can lead to: **generating knowledge** in the form of academic literature – scientific articles, seminars, expertise grey literature – reports, policy briefs or mass media production – press articles, videos, podcasts; **gathering and organizing collective action**, following the model of grassroots movements; and/or opening the doors to **entering public debates** and political arenas.

This last point is crucial and stems from the first two types of outcomes. **Interdisciplinary work with political scientists is called for, especially in the field of analysis of public policies**. In France, political scientist are engaged in academic field studies on how ideas, elaborated and supported by identified actors, are set into the political agenda and influence public policies. **The legitimacy of the actors, the channel chosen for communication and the timing are key in this process.**

In the example of *TYFA*, the main report was published on the IDDRI website (a French independent think-tank) in September 2018 and relayed by different media and social networks. It was then used as a solid quantified argument during the European debate on the *Farm-To-Fork* strategy. One of the authors explained that their work could be compared to the "production" of an idea or argument, **fitting the language of policymakers by quantifying**. Its publication entered a "market of ideas" that are available to the political sphere to feed debate. In this case, the idea succeeded in entering the political arena. However there was the risk of losing control of the results, which can be instrumentalized to justify pre-designed policies.

Entering public debate also refers to the contemporary questioning of **the issue of trust between Science and Society**, at the policy level but also when it comes to public opinion. Efforts need to be enhanced when **communicating with the public**, and **field of vision broadened for this type of communication**. An entire strategy should be implemented, with the help of **media, social networks, mediation expertise, as well as culture and art professionals**. The achievement of this final phase is partly in the hands of the various actors involved in the process, but with different responsibilities, which are presented in the following paragraphs.

Anticipating communication by commissioners and implementers

Communication does not start at the end of the foresight process, and a foresight process does not end with the publication of a report. **The results of the process need to be disseminated and presented in various arenas to keep it alive and to nurture debates on agroecology.** Therefore, implementers should not stop at the stage of publication solely because of academic reasons. **Scientific publication (especially through peer-reviewed journals) is key to feeding knowledge production on both agroecology and foresight, but it is not the end point.** The communication step should be **discussed in depth among implementers and commissioners, and the latter should ensure that publication is a step when ordering such a study.** Commissioners should also be aware of the issues raised by the rapid turn-over in their teams. The results of a foresight process risk not being communicated well, when a driving member of the ordering body leaves the team.

Ensuring implementers have a good communication strategy

In addition to the publication of reports and/or scientific articles, a classical communication strategy comprises the **presentation of the results for debates at a number of meetings with public and private decision-makers**, conferences, etc. When stocktaking the present document, a series of interesting communication initiatives were found, even though not all processes had been finalized so that the communication and debates have not all begun.

Often, communication is difficult for foresight processes, because participants are encouraged to think "out-of-the-box", whereas those listening to the presentations will have their own views and expectations that are often still "in the box". **Communication, therefore, needs to be tailored to the listeners, fit their needs, preoccupations and interests and contribute to changes in attitude.**

The objective of communication is to **pique interest, draw support, persuade and attract attention.** Therefore, the mode of communication should **stimulate thought, engage the emotions, motivate and spark action.** Messages should be clear, so as to enlighten and prevent misunderstanding. **Verbal and visual communication channels or design are more effective in changing mental images** and models, and illustrating pathways and levers, than a long and complicated report. **Giving short and visual names to narratives, which can be illustrated with drawings or video**, can be useful. Creating a vision of actors and their networks is also a good way to communicate foresight. Moreover, **quantitative results are appreciated** because they can be easily communicated in a colourful graph and are adapted to the Cartesian worldview.

A broad diversity of communication channels should be employed, although most foresights are presented academically. This contributes to their having insufficient impact on decision-making. Communication about alternative futures and strategic pathways is **crucial to building new social images in public opinion and for decision-makers. Collaboration with traditional, and cultural and educational media represent having crucial avenues to use in foresight for agroecology**.

Participants' appropriation of the results

Communication is important throughout the process and already takes place with the engagement of stakeholders who **obtain a wealth of information and will share their new ideas with others**. Once the scenarios are built and strategic options proposed, **one indicator of the success of the foresight process is the appropriation of the results by the participants, so that communication with outside arenas channels through them**. This demonstrates the importance of fostering a collective dynamic among the group that can emerge or be enhanced if it already exists. The example of the participants of *FAIR Sahel/Fatick* is informative. They have started to advocate for agroecology at several local meetings by using the scenarios as an important pedagogical support.

BOX 10

PHASE 7: RECOMMENDATIONS RELATIVE TO COMMUNICATION AND DEBATES

Recommendations for commissioners of foresight processes

- Develop a communication strategy with the foresight and agroecology practitioners of the process as well as with participants, targeting different arenas to enlarge possible futures and keep the process alive and nurture debates on agroecology.

Recommendations for foresight and agroecology communities

- **Communicate throughout the foresight process.** What is at stake is to move from discourse to transformative action for agroecology, by fostering new public decisions, and new strategies and practices for actors. Communication about alternative futures and strategic pathways is therefore crucial to creating new social imaginaries in public opinion and for decision-makers. Collaboration with traditional media, but also cultural and educational media represents crucial avenues in the use of foresight for agroecology.
- **Develop a communication strategy together** that targets different arenas to enlarge possible futures and maintain and nurture debates on agroecology. Communication should be tailored to fit the needs and interests of the readers or listeners. Develop messages for all types of actors, and not exclusively for policymakers.
- **Diversify the media chosen to disseminate the results as well as the information provided according to the audience.** The appropriate format for communicating foresight to decision-makers with diverse involvement varies from a two-minute pitch to a detailed technical report. Other communication formats are policy briefs, articles in newspapers and peer-reviewed journals, expert hearings, conferences, podcasts and videos, infographics, websites, games and even virtual reality.

Source: Authors' own elaboration.

5. Conclusion: how can foresight contribute to the transformation of food systems through agroecology?

The transformation of food systems appears to many scientists as an opportunity to regulate climate, restore biodiversity, rethink the social distribution of value and give new meanings to employment, while fulfilling our essential need for food (Webb *et al.*, 2020). Three conclusions were drawn from the analysis of the literature of foresight studies reviewed, placed in the perspective of the broader literature.

5.1 FORESIGHT PROCESSES SHOW THAT AGROECOLOGY IS NOT MONOLITHIC AND OFFERS MANY DESIRABLE SYNERGIES IN THE FOOD SYSTEM. THEY ALSO SHOW THAT TRADE-OFFS SHOULD BE ANALYSED AND DISCUSSED...

In all the foresight studies analysed, the business as usual scenario is not desirable. Contrasting with this option, agroecology opens up many opportunities. Much of the literature, including foresight, shows that agroecology can have positive outcomes on food security and nutrition (Kerr *et al.*, 2021). The literature provides many documented improvements and synergies at different scales, particularly for the health of human populations and ecosystems. By combining endogenous knowledge and scientific ecology, agroecological agronomic practices can significantly decrease the use of chemical inputs and fossil fuels, and allow for increased bio- and agrobio-diversity and carbon sequestration. With its more labour-intensive and diverse practices, agroecology can potentially lead to greater employment, as well as revenue diversification for farmers (Leippert *et al.*, 2020). Shortening the distance between producers and consumers, as proposed by agroecology, can also raise producers' revenues while increasing access to quality and diverse food for all (Brown and Miller, 2008).

Agroecology also stands for defending food as a cultural marker to avoid uniformity; it supports agriculture as an ethical modality of interaction with nature; and defines food sovereignty as a global objective to redesign the world trading regulations.

Yet, the study reveals that implementing agroecology at a large scale may result in many trade-offs that need to be debated and solved. Trade-offs especially concern the question of land use and the place of forest areas, the use of different sources of energy, the nitrogen balance and dependence on imports. This sort of Schumpeterian reconfiguration of the food system (by creative destruction) would necessarily entail winners and losers of the transformation. Attention should therefore be focussed on the socioeconomic and political implications, especially for the most vulnerable social groups who could become the losers. Implementing agroecology also requires tremendous effort in innovation, technical or social, the creation of a new perspective that needs to be combined with the old. This is because innovations need to be context-specific and not universal.

Furthermore, it appears that agroecology is not monolithic. The concept is loosely defined, as it has been constructed throughout a long history, or *histories* since this construction has been fairly diverse depending on geography. Controversy enriches discussions among its proponents, such as different representations of the scales of transformation (only at the scale of the farm but also the food system) or different positions concerning pesticides, biotechnologies, digital technologies and the size of farms. This leads to several visions of agroecology that have different impacts, which is why it is so important to explore different scenarios testing agroecology.

There is, therefore, no universal solution for the transformation of food systems. Each country should identify local and national policies to foster agroecological approaches, their levers and feedback loops, their synergies and rebound effects, as well as the power balance between the actors in the food system.

5.2. ... AS THEY CAN BE SOURCES OF TENSION AMONG THE ACTORS OF THE FOOD SYSTEM. FORESIGHT OFFERS DEBATE SPACES TO EASE THE TRANSFORMATION OF FOOD SYSTEMS...

The future of agroecology depends on the capacity of diverse worlds to create common ground and foster trust through social imaginaries, knowledge, networks and collective action. The multitude, as a mode of organization in networks, with no coordinator or leaders, requires a certain unity to aggregate and act. There is a need, among actors having different conceptions of agroecology, but also with other actors, to outreach dogmatic positions and design a common strategy for transformative action. Reality is far from the binary opposition between one type of food system and the alternatives. These are archetypes, theoretical artefacts that can be useful but also blinding.

In the field, the co-existence of food systems within territories is a fact (Gasselin *et al.*, 2021): there is a mosaic of configurations, practices and ideas at this scale need to be finely understood. It implies, first of all, communication among actors on a daily basis as with relationships between neighbours. The mosaic opens up to many levers for action. There are functional complementarities between food systems, such as the complementarity between specialization and diversification that can create synergies. Innovations are often a cause and a consequence of co-existence: they modify the conditions of co-existence but are also the result of the higher potential of innovation through hybridization. Adaptation and transition processes at the level of a territory also occur through situations of coexistence.

Admittedly, this co-existence is confronted with imbalances of power between actors, which can lead to the grabbing of ideas and resources, or marginalization, and can explain part of the inertia of current food systems. The debate remains highly political, and therefore dependent on ideologies, world visions, interests and networks. Political struggles are of course necessary for transformation, although they can lead to violent situations, especially when it comes to competition for resources (land and water, public funds, human resources for employment, consumers, etc.). But cooperation and negotiation are also required for change. If agroecological transition often focus on the agricultural practices of farmers, it is time to acknowledge that these practices are shaped by the configuration of the entire food system. This acknowledgment will lead to improved integration of the risks, power and responsibilities of the different actors.

Creating new dynamics in this sense requires friction and articulation of different forms of organization and actors, at different scales and in different types of territories. Foresight requires the existence of a public space at the local level where the words of others are respected, not rejected a priori. This is especially true for women and young people, whose participation should not be viewed as an injunction but as a necessity and source of creativity. This arena would provide an opportunity for seeking common ground and exposing the roots of incompatibilities so as to go beyond polarization. Foresight offers adapted tools for doing so, as it gathers different actors together to discuss the variables that are key to the functioning of the food system, to learn from each other, and to draw different possibilities for the future, a temporal "space" that is beyond current interests and conflicts.

5.3 ... BUT ALSO STRUCTURES THESE DEBATES AMONG THE FOOD SYSTEM ACTORS. IT PROVIDES TOOLS TO BUILD STRATEGIC THINKING FOR DECISION-MAKING TO COMMUNITIES AND POLICYMAKERS, AND TO OPEN UP POSSIBLE FUTURE CONCEPTS WITH AGROECOLOGY

Foresight can have various non-exclusive objectives: advocating; structuring debate; assisting decision-making; assessing public policies; empowering actors, de-conditioning viewpoints, etc. Foresight approaches invite participants to open up to future possibilities. In this respect, the diversity of methodologies is key.

Quantitative models help to materialize the orders of magnitude involved in transformation, and should be employed to explore metrics that are better adapted to agroecology.

Qualitative narratives provide far more details and inspire substance in the exercise. Both approaches are essential and should be articulated correctly (Jahel *et al.*, 2023). Building contrasting agroecological scenarios is useful so as to: better understand the present; identify the diversity of mechanisms and rationales in place, their complementary and incompatibilities, comprising levers and lock-ins for change; visualize ruptures and daring to be radical.

Food system transformation requires social change, which will be revealed in the modalities selected for the drivers. It is necessary to embrace the entire food system; diverse scenarios can emerge from the combination of futures for each part of the system. From a macro perspective the food system can be replaced; transforming such systems will have a significant impact on other economic structures, which will lead to structural changes on a large scale.

Foresight approaches can prepare us for action and operationalize discourse, by structuring communities or co-building public policies. To do so, the articulation of scales is essential, the local scale is key to drawing future landscapes and to implementing public policies. Foresight approaches are equipped with the relevant theories and tools to facilitate mediation in such an arena and facilitate the structural transformation of food systems towards agroecology. Foresight offers the movement the opportunity to foster its legitimacy by directly debating with policymakers, at different organizational scales and levels.

Creating alternative futures, as a realm of freedom, power and will (de Jouvenel, 2004; Treyer, 2022) helps build a powerful social vision, contribute to the restructuring of the balance of power in order to transform the current practices of policymakers, the industry, consumers and farmers. Facilitating such processes requires time, resources and training, especially to balance power within participant groups and not to change the groups into manufacturers of consensus or of legitimation.

In a nutshell

Desirable transformation of food systems does take place in the scenarios involving agroecology. Health of humans and ecosystems improves and food is available at a global scale. However, there are always trade-offs and questions concerning the socioeconomic and political implications. Agroecology cannot solve all problems, and is confronted with the path of dependency on food systems in the current dominant sociotechnical regime.

The reality of food systems is complex, where diverse models coexist, and there is a dynamic ecosystem of organizations that are characterized by the presence of oligopolies, having different levels of power, network structures and financial capacity. Food systems are, therefore, diverse and diversifying. In some countries multiple models currently co-exist and interact, in dual forms: traditional family farming and agro-industry, and in most cases transformation is gradual, towards hybridization and novelty.

The future of agroecology will, therefore, be shaped by its different interactions with other agrifood models, be they "co-presence, cohabitation, complementarities, synergies, co-evolutions, hybridizations" or on the contrary "confrontations, competitions, marginalization and exclusions" (Gasselin *et al.*, 2021). Foresight can accompany the re-politization of the future, with humility in face of our capacity to pilot institutions, and even humbler to change them at the required velocity. Foresight can be employed, among other approaches, by co-existing actors in their food systems as a "drafting table" where actors can draw upon their common understanding and shared direction.

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Annex 1: Concept note and workshop agenda "Exploring sustainable futures through agricultural foresight exercises"

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Concept Note

"Exploring sustainable futures through agricultural foresight exercises:
method, purposes and implications"
7 and 8 November 2022, Ethiopia Room (C285), FAO Headquarters. (Rome, Italy)

Background

Current global challenges put strong emphasis on the urgent need for a sustainable transformation of agriculture and food systems. Recognizing these challenges, the FAO Strategic Framework 2022-2031 focuses on the transformation to MORE efficient, inclusive, resilient and sustainable agri-food systems. As recognized by several landmark reports, integrated biodiverse approaches including agroecology are a key part of the response, bridging the economic, environmental and social dimensions of sustainability.

As the pace of change increases, decision-makers wade through files marked 'for immediate action' classified increasingly by the degree of urgency involved. Consequently, only when a problem becomes urgent does it come up. And without anticipation there can be no freedom in making a decision. Foresight processes that properly incorporate integrated biodiverse approaches – including agroecology- to foster sustainable food system transformations can help decision-makers prepare for an anticipated change and provoke a desired change that is supported by the majority of stakeholders.

Therefore, sustainable food system transformation require appropriate tools designed to make behavior change attractive. In particular, agricultural foresight methodologies need to take into account complex agricultural practices (from production to consumption) that are context specific and territory-based, incorporating biodiverse and integrated production systems that favour such transformations, and that engage a broad set of stakeholders that represent all sectors of society in building future scenarios. Such adapted foresight methodologies could build up confidence among policy makers in options towards transformative development pathways that have been little explored until now.

Objectives

The Food and Agriculture Organization of the United Nations (FAO), the French Agricultural Research and International Cooperation Organization (CIRAD) and the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) are co-organizing the Global Workshop "***Exploring agroecological futures: method, purposes and implications***", to be held in FAO Headquarters, Rome Italy, on 7 and 8 November 2022. The Workshop aims at increasing knowledge sharing and drawing recommendations on the role of foresight processes to support sustainable food system transformations through agroecology. This Workshop is organized as a key component of the global project "**Foresight on Challenges and Opportunities for Sustainable Food Systems & Agro-Ecological Transition**" (GCP /GLO/1039/GER-F) implemented by FAO, in collaboration with CIRAD and with financial support from GIZ.

Specific objectives of the Workshop

i) take stock of past and on-going foresight processes and scenario exercises and the extent to which they include agroecological scenarios for sustainable food systems;

ii) draw lessons from different methods used (comparing approaches, methodologies, outcomes); examine how these initiatives have been connected to policy processes and how this might be improved to support

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sustainable food systems transformations through agroecology.Lessons drawn will guide the use of foresight to support sustainable food system transformations through agroecological approaches that could be relevant at different levels and contexts.

Methodologies and stakeholder participation

The first section of the workshop will last 1 and a half day and it will bring together foresight practitioners, scientists and policy experts working on foresight processes to support evidence-based policy processes for sustainable food systems transformations including through agroecology. (Estimated size 30 participants). A collective "State of the Art" exercise will be done and participants will share experience on specific themes.

The afternoon of the 2nd day, during a 2 hour "Online Open Session", representatives of decision-makers, farmer organizations, private sector, civil society organizations, foresight practitioners, agroecology practitioners and public authorities will be invited to virtually join the workshop. The goal of this session is to present and discuss key outcomes of the workshop and raise awareness on the use of foresight processes to support sustainable food system transformations through agroecology.

Expected Outcomes

Multi-disciplinary and collective contributions to specific project outcomes, including:

a) a global State of the Art on foresight initiatives that support sustainable food system transformations through agroecology;

b) recommendations on the use of foresight exercises to facilitate agroecological transitions that could be relevant at different levels and contexts;

Virtual connection link https://fao.zoom.us/meeting/register/tJUodO2przljGd0DOdam47wkMdLPgmEvJxlL

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DRAFT AGENDA

DAY ONE	7 November 2022
Time	**Agenda item and presenter**
	SETTING THE SCENE
08:30 - 9:00	Registration of participants
09:00 - 09:10	Welcoming remarks by Emma Siliprandi, Agricultural Officer, Ecosystem Approaches to Crop Production Intensification Unit, Plant Production and Protection Division, FAO
09:10 - 09:20	Opening remarks by Ute Rieckmann, Team Leader, Support of Agroecological transformation processes in India (SuATI), GIZ
09:20 - 09:30	Opening remarks by Sylvain Perret, Director of Department Environment and Societies, CIRAD
09:30 - 09:40	Background and Objectives of the Workshop by Anne-Sophie Poisot, Assistant-Team Leader, Pest and Pesticide Management Unit, Plant Production and Protection Division, FAO
09:40 - 09:55	Audio-visual presentation
	STATE OF THE ART ON FORESIGHT PROCESSES FOR SUSTAINABLE FOOD SYSTEM TRANSFORMATIONS TROUGH AGROECOLOGY
09:55 - 10:35	Presentation **"Why foresight and what is it?"** by Bruno Dorin, Senior Researcher, CIRAD and Jean-Michel Sourisseau, Deputy director of the Joint Research Unit ART-Dev, CIRAD.
10:35 - 10:50	Coffee break
10:50 - 11:25	Presentation "**Draft Stocktaking Report on Participatory Foresight for Sustainable Food System Transformations through Agroecology**", by Fatma Rostom, Researcher, CIRAD. (25' Presentation + 10' Q&A)
11:25 - 12:30	**Presentation of foresight processes by participants – PART I** 1. Molly Anderson, Academic Director, Middlebury College. 2. Nick Jacobs, Director, IPES Food. 3. Jim Woodhill, Honorary Research Associate, University of Oxford. 4. Bruno Dorin, Senior Researcher, CIRAD. 5. Sylvain Doublet, Head of Research and Project Activities on Bio-resources, Solagro. 6. Xavier Poux, Senior Project Manager, AScA. 7. Aristide Sempore, Agricultural Innovation Project Manager, Dedougou University, Burkina Faso.
12:30 - 13:45	Lunch break
13:45 - 14:30	**Presentation of foresight processes by participants – PART II** 1. Andreas Mayer, Senior Researcher, University of Natural Resources and Life Sciences, Vienna. 2. Jesus Barreiro Hurle, Senior Scientist, European Commission Joint Research Center

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	3. Marie de Lattre-Gasquet, Senior Researcher, CIRAD and Nejia Hayouni, Director of Studies and Planning, Ministry of Agriculture, Hydraulic Resources and Fisheries, Tunisia. 5. Simona Pedde, Researcher, University of Wageningen, Netherlands. 6. Mercedes Patrouilleau, Researcher, National Institute of Agricultural Technology, Argentina. 7. Emil Zaharia-Kézdi, Senior modeler, Millenium Institute & Biovision. 8. Jean-Michel Sourisseau, Deputy director of the Joint Research Unit ART-Dev, CIRAD.
14:30 - 16:00	**Theme 1: Drivers and outputs in foresight exercises for food system transformations through agroecology** 10' presentation of main observations of Report 15' Reactions by *Molly Anderson*, Academic Director Middlebury College and *Steven McGreevy*, Assistant Professor, University of Twente. Reactions from participants
16:00 - 16:30	Coffee break
16:30 - 18:00	**Theme 2: Participatory approaches in foresight exercises for food system transformations through agroecology** 10' presentation of main observations of Report 15' reactions by *Lauren Baker*, Director of Programs, Global Alliance for the Future of Food and *Mercedes Patrouilleau*, Researcher, National Institute of Agricultural Technology, Argentina Reactions from participants
DAY TWO	**8 November 2022**
Time	**Agenda Item and Presenter**
08:30 - 10:00	**Theme 3: Geographical scales in foresight exercises for food system transformations through agroecology** 10' presentation of main observations of Report 15' Reactions by *Fergus Sinclair*, Chief Scientist, Center for International Forest Research – World Agroforestry and *Pablo Tittonell*, Principal Research Scientist in Argentina's National Council for Science and Technology. Reactions from participants
10:00 - 10:30	Coffee break
10:30 - 12:10	**Theme 4: Implications of foresight exercises for agroecology on policies and governance** 5' presentation of main observations of Report 15' Reactions by *Nejia Hayouni*, Director of Studies and Planning, Ministry of Agriculture, Hydraulic Resources and Fisheries, Tunisia and *Cecilia Elizondo*, Adviser, Intersectoral Group on Health, Food, Environment and Competitiveness (GISAMAC), México. Reactions from participants
12:10 - 12:30	Break – Preparation of key conclusions
12:30 - 13:00	Key conclusions and closure of Workshop
13:00 - 14:30	Lunch break

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WEBINAR "FORESIGHT PROCESSES FOR SUSTAINABLE FOOD SYSTEM TRANSFORMATIONS TROUGH AGROECOLOGY"

14:30 - 14:35	**Welcoming remarks and introduction** by Robin Bourgeois, Senior Researcher, CIRAD.
14:35 - 14:45	**Building sustainable food systems through agroecology**, Ronnie Brathwaite, Team Leader, Ecosystem Approach to Crop Production Intensification Unit, Plant Production and Protection Division, FAO.
14:45 - 14:55	**Agroecology in German Development Cooperation: lessons learnt and challenges**, Ingrid Prem, Programme Manager for Rural Development, GIZ.
15:55 - 15:20	**Key features of foresight for agroecological transitions and main recommendations**, Marie de Lattre-Gasquet, Senior Researcher, CIRAD.
15:20 - 16:10	**Interactive panel discussion** - Jim Woodhill, Senior Consultant, Foresight4Food Initiative. - Lorenzo Giovanni Bellù, Senior Economist, Agrifood Economics Division, FAO. - Molly Anderson, Member, International Panel of Experts in Sustainable Food Systems IPES-Food. - Esther Penunia, Secretary General, Asian Farmers' Association for Sustainable Rural Development and Interim Coordinator of the Agroecology Coalition. - Eduardo Cerdá, Director, National Directorate of Agroecology, Ministry of Agriculture, Livestock and Fisheries, Argentina.
16:10 - 16:20	**Concluding remarks**, Anne-Sophie Poisot, Agricultural Officer, Pest and Pesticide Management Unit, Plant Production and Protection Division, FAO
16:20 - 16:30	**Closure of meeting**, Bruno Dorin, Senior Researcher, CIRAD

The Event will be moderated by Robin Bourgeois, Senior Researcher, CIRAD. It will feature interpretation in English, French and Spanish.

Annex 2

Workshop participants

First name	Last name	Organization	Role/Title
Molly	Anderson	Middlebury College, VT, USA	Academic Director
Jesus	Barreiro Hurle	European Commission Joint Research Center (Belgium)	Senior Scientist
Ashish Kumar	Bhutani	Goverment of Assam, India	Additional Chief Secretary, Agriculture
Eveline	Compaore	INERA Environment and Agricultural Research Institute, Burkina Faso	Researcher
Nejia	Hayouni	Ministry of Agriculture, Hydraulic Resouces and Fisheris, Tunisia	Director of Studies and Planning
Anne-Sophie	Siliprandi	FAO, Italy	
Colin	Anderson	University of Vermont, USA	
Lorenzo	Bellu	FAO, Italy	
Robin	Bourgeois	Cirad, France	Senior Researcher
Gabriela	Bucini	University of Vermont, USA	
Ashirbad	Das	GIZ, India	SuATI-Advisor Research & Policy
Marie	de Lattre-Gasquet	Cirad, France	Senior Researcher
Bruno	Dorin	Cirad, France	Senior Researcher
Théophane	Hazoume	Cirad, France	Junior Researcher
Nick	Jacobs	IPES Food (Belgium and UK)	Director
Preeti	Maithil	Government of Madhya Pradesh, India	Director Agriculture
Andreas	Mayer	University of Natural Resources and Life Sciences (BOKU), Vienna, Austria	Researcher
Raoul	Mille	Permanent Mission of France to the UN in Rome	Conseiller scientifique
Liesa	Nieskens	GIZ, Germany	Advisor on AE-knowledge exchange
Mercedes	Patrouilleau	National Institute of Agricultural Technology, Argentina	Researcher
Simona	Pedde	University of Wageningen, The Netherlands	Researcher
Rémi	Prudhomme	Cirad, France	Researcher
Ute	Rieckmann	GIZ, Germany	Team Leader
Fatma Zahra	Rostom	Cirad, France	Junior Researcher
Jean-Michel	Sourisseau	Cirad, France	Deputy director of the Joint Research Unit ART-Dev
Berthold Ernst	Wohlleber	GIZ, Germany	Advisory
Jim	Woodhill	University of Oxford, Environmental Change Institute, UK	Honorary Research Associate
Emil	Zaharia-Kézdi	Millenium Institute (USA) & Biovision (CH)	Senior Modeler

On-line participants

First name	Last name	Organization	Role/Title
Lauren	Baker	Global alliance for the Future of Food	Researcher
Sylvain	Doublet	SOLAGRO, France	Researcher
Cecilia	Elizondo	GISAMAC, Mexico	
Saher	Hasnain	Univ of Oxford	
Steven	Mc Greevy	University of Twente, NL	Researcher
Xavier	Poux	Institut des Sciences politiques, France	Researcher
Sylvain	Perret	Cirad, France	Director, environment and society department
Aristide	Sempore	Dedougou University, Burkina Faso	Researcher
Fergus	Sinclair	CIFOR-ICRAF	Chief scientist
Pablo	Tittonell	CONICET-INTA, Argentina	Principal Researcher Scientist

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