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# The agroecological transition of agricultural systems in the Global South

F.-X. Côte, E. Poirier-Magona,  
S. Perret, P. Roudier,  
B. Rapidel, M.-C. Thirion,  
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# The agroecological transition of agricultural systems in the Global South

François-Xavier Côte, Emmanuelle Poirier-Magona,  
Sylvain Perret, Bruno Rapidel, Philippe Roudier,  
Marie-Cécile Thirion, editors

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# Foreword

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The world today continues to produce food primarily on the basis of the principles of the Green Revolution. Most of this production thus relies on input- and resource-intensive farming systems, with obvious heavy costs to our environment. Soils, forests, water, air quality and biodiversity continue to degrade inexorably. And this drive to produce at all costs has not been completely successful because hunger remains an uncomfortable reality across the globe. And this even though we currently produce more than enough to feed everyone. At the same time as this reprehensible situation, we are witnessing a global obesity epidemic. This is an unsustainable behaviour and we need to promote a transformation in the way we produce and consume food. We need to design sustainable food systems that not only provide a healthy diet but also protect the environment.

Over the past decade, agroecology has drawn increasing interest and, according to many stakeholders, represents a strategic approach that can enable a successful transition to more sustainable farming and food systems.

It is in this context that we at the FAO organized a series of multi-stakeholder seminars on agroecology between 2014 and 2018. These events offered the various participants an update on the many facets of agroecology and highlighted its beneficial role. Arenas for animated exchanges and useful debates, these events prompted an important and significant mobilization of civil society and the research community. They provided opportunities to these actors to clearly express their expectations for strengthened institutional support for agroecology. They have thus shown how agroecology, although a concept that has always been framed scientifically since its birth almost a century ago, remains a spirited and strong approach, very dependent on the context in which it is sought to be applied. This mobilization has generated in its wake a dynamism and a great hope around agroecology and the solutions that this new agricultural model may be able to provide to the challenges reflected in the 17 Sustainable Development Goals to be achieved by 2030. To convert this dialogue on agroecology into action, an initiative for its scaling up was launched by FAO and its UN partners at the Second International Symposium on Agroecology in April 2018. We also commend France for its exemplary commitment to agroecology and for its ongoing support to FAO in this area.

The policy adopted by France in favour of agroecology is indeed exceptional because it addresses all the levers needed to promote the agroecological transition, from production to consumption, by way of a transformation of the systems of education,

research and innovation. To this end, French research and development organizations are providing significant scientific and methodological support for the development of agroecology at the international level. This is why we, in early 2018, strengthened our cooperation with French research and higher-education institutes in the form of a partnership framework contract. This contract is focused on developing countries and aims to promote the agroecological transition as one solution among others for achieving food and nutrition security in the ever-lengthening shadow of climate change.

This book presents the experience of ten years of work by the Centre for International Cooperation in Agricultural Research for Development (CIRAD) and the French Development Agency (AFD). It capitalizes an extremely valuable expertise, illustrated with examples from successful initiatives in Africa, Asia and Latin America, to guide us in the transition to agroecology. The reader can benefit from CIRAD's excellent research work on leveraging biodiversity in agrosystems, the optimization of biogeochemical cycles, management at the landscape and territory scales, as well as the creation and assessment of production systems that maximize ecosystem services. The analysis jointly proposed by CIRAD and AFD also shows us how the agroecological transition cannot be limited simply to an introduction of ecological principles into agricultural systems and how it must go through a phase of organizational and institutional innovation, consisting of a comprehensive and holistic approach to the entire agricultural and food system, in order to initiate a transformation towards more sustainable production and consumption.

I am therefore delighted at release of this very useful book, whose publication is particularly timely as it will help to further FAO's reflections and actions and those of all its partners. This volume will, in this way, help advance agroecology so that this approach can be scaled up, bringing us thus closer to the realization of the plan of action for people, planet and prosperity: the 2030 Agenda for Sustainable Development and its 17 Sustainable Development Goals.

*José Graziano da Silva*

*Director general*  
Food and Agriculture Organization  
of the United Nations (FAO)

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# Introduction

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Agriculture has made a recent return to international agendas in its role as a lever of development in countries of the Global South and as a major instrument for achieving several of the UN's sustainable development goals. While it is acknowledged that agriculture in these countries must meet the food and economic needs of their rural and urban populations, new priorities have been added to this agenda: preserving resources and ecosystems, promoting territorial development and employment of rural youth, responding to the demands of an increasingly globalized market, contributing to the health and well-being of the population through the quality and diversity of its products, adapting to climate change, etc. These new exigencies call for unprecedented and rapid transitions in agricultural systems in these countries.

Such transformations have to take place in a fast-changing and uncertain context, marked, on the one hand, by changes in the demographics of many countries of the Global South, accompanied by rapid urbanization, on the other, by low investments in agriculture and inadequate public services, by the globalization of trade and private investment, and the expanding reach of agro-industries, and by difficulties in the conditions of agricultural production (climatic extremes, favourable conditions for proliferation of pests, depleted and fragile soils, water shortages due to climate change, etc.).

The different forms of agriculture in the Global South have also to evolve without reproducing the impasses and negative impacts – social, nutritional and environmental – of the Green Revolution's productivist models. It is in this context that new agroecological practices are beginning to emerge. They are based on the mobilization of the ecological functionalities of agricultural systems, the optimization of natural processes, and the frugal management of resources. Agroecology cannot, however, be reduced to a set of technical practices. The agroecological approach corresponds to a paradigm shift that addresses the concerns of citizens and consumers regarding their nutrition, their health, ecosystems, equity, and social and environmental responsibility. It calls for a new way of assessing the performances of production and processing systems, and requires a different kind of logic of innovation. To go from the agricultural model promoted by the Green Revolution to that of agroecology, we have to leave behind the prescriptive 'top-down' logic of technical change, based on the implementation of standardized technical packages. We have to transition instead to a logic of innovation backed by a network of diverse actors, including, of course, the producers themselves, and one that is based on the analysis of local contexts and needs and on the development at the territorial scale of the most suitable biological, technical and institutional solutions.

The French Centre for International Cooperation in Agricultural Research for Development (CIRAD), as part of its research mission, and the French Development Agency (AFD), as part of its mandate of providing development aid to countries in the Global South, are exploring the possibilities of developing systems based on the scientific principles of agroecology. Several dozen research and development projects on the agroecological transition have been conducted by these two organizations in partnership with researchers and local entities of the Global South in recent years, mainly in Africa, Madagascar and the Indian Ocean, in Southeast Asia, Latin America, as also in the French Overseas territories.

This book reports on some of these research and development activities, all of which are part of a general, participatory and territorialized action-research approach aimed at the co-production of a number of common goods: knowledge (scientific and endogenous knowledge), practices, partnerships (groups, networks, innovation platforms, etc.), skills (training, increase of social capital, imparting of knowledge through exchanges and learning), and, finally, innovation approaches themselves.

The book is divided into two main parts.

The first part describes nine case studies of the implementation of agroecological systems or practices by producers, the research community and various actors of development in different production contexts in the countries of the Global South: mixed crop-livestock systems in Burkina Faso; food crops in Madagascar; cocoa cultivation in agroforestry systems in sub-Saharan Africa; nets to protect market-garden crops from pests in Africa; the agroecological transition in Laos; banana cropping systems with reduced pesticide use in the French West Indies; agroecological horticultural systems in Réunion; coffee-based agroforestry systems in Central America; and the development of coffee varieties suited to these systems. The results of these case studies make it possible to discuss the determinants of the agroecological transition, the technical and organizational solutions that have been identified, and the performances achieved by the new systems.

The eight thematic chapters of the second part consist of reflections on the implementation of the agroecological transition: the determinisms of the development of agroecology; natural regulation processes and the use of biodiversity that can be mobilized for agroecological solutions; the evaluation of the performances of these systems; agroecology and climate change; the ecologization of agriculture through the prism of collaborative innovation; market dynamics to promote the agroecological transition; and territorial mechanisms to enable the agroecological transition. The determinants of the agroecological transition and the genericity of the technical, organizational and collaborative approaches mobilized for this transition in different contexts of the countries of the Global South are presented and discussed in this half of the book.

Finally, the conclusion presents the main lessons learned from the work of CIRAD, AFD and their partners on the implementation of the agroecological transition. The discussions bear, in particular, on the ways in which the very diverse agricultural models in countries of the Global South can all be made to undergo an agroecological transition, the various trajectories that this transition can take, and the genericity of

its biophysical and organizational levers. Finally, this summary reminds us of the new challenges that will have to be met and the conditions that will have to be satisfied before the agroecological transition can take place at a significant scale.





Part 1

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Case studies



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# Co-design of innovative mixed crop-livestock farming systems in the cotton zone of Burkina Faso

*Éric Vall, Mélanie Blanchard, Kalifa Coulibaly, Souleymane Ouédraogo, Der Dabiré, Jean-Marie Douzet, Patrice K. Kouakou, Nadine Andrieu, Michel Havard, Eduardo Chia, Valérie Bougouma, Mahamoudou Koutou, Médina-Sheila Karambiri, Jethro-Balkewnde Delma, Olo Sib*

Producers in western Burkina Faso have to contend with high rainfall variability and very volatile agricultural prices (Cooper *et al.*, 2008). Such uncertainties have led the vast majority of them to diversify their production and practise mixed crop-livestock farming using low levels of inputs in order to ensure their food self-sufficiency while containing economic risks. Their mixed crop-livestock farming systems are based on cotton, cereals (maize, sorghum), legumes (groundnuts, cowpeas), and the rearing of cattle and small ruminants (Vall *et al.*, 2006).

Producers have, for a long time, favoured a strategy of extension of cropping areas and increase in herd sizes, as long as space is available to them to do so, both for extending cropping areas and for new pastures (Milleville and Serpantié, 1994). However, as population and, consequently, the pressure on the land increased, producers opted to implement strategies to intensify agricultural production (Ouédraogo *et al.*, 2016; Jahel *et al.*, 2017). Intensification of production is meant to enable them to maintain, or even increase, production levels to meet the growing local demand for agricultural products (Bricas *et al.*, 2016). Agricultural policies and development entities have thrown their weight behind this intensification to achieve food security and increase exports<sup>1</sup>. This has resulted in the decrease in fallows, the transition to continuous cultivation, overgrazing, and an increased use of synthetic inputs (Vall *et al.*, 2017). Producers have also intensified production by strengthening the association between agriculture and livestock husbandry in order to be more self-sufficient in agriculture energy, animal feed and organic manure. However, the sustained increase in agricultural and pastoral pressure on natural resources has resulted in their degradation

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1. <https://www.agriculture.bf> (retrieved 23 March 2019).

and fragilization, leading to a decline in soil fertility (Bationo *et al.*, 2007), an impoverishment of pastures (Vall and Diallo, 2009), and a critical decline in the potential for production and regeneration of agroecosystems.

In such a context, an agroecological transition must be encouraged to diversify and increase agricultural production in a sustainable manner, while safeguarding agroecosystems. This kind of transition, however, requires profound changes in farming practices (Duru *et al.*, 2014; Tittonell, 2014) and, consequently, calls for efforts to co-design innovative farming systems with the involvement of producers to try out, assess and adapt new practices, and to provide support to producers in these changes (CIRAD, 2016). It is in this perspective that, since 2005, co-designing of innovative mixed crop-livestock farming systems was taken up in western Burkina Faso in order to analyse the interactions between vegetation, livestock herds and cropping at different scales (farm, territory), and to look for ways to optimize these interactions in order to achieve a sustainable intensification (Vall *et al.*, 2016a).

After recalling the principles of the co-design of innovative farming systems, we will present a summary of the developments observed in the mixed crop-livestock farming systems. We will then highlight examples of the design of agroecological, technical and organizational innovations, carried out at the scales of territories, farms and production systems. We will conclude by reviewing the lessons learnt from the successes and failures of such efforts.

## **MECHANISMS FOR THE CO-DESIGN OF INNOVATIVE MULTI CROP-LIVESTOCK SYSTEMS**

Undertaken as a result of a combination of a desire for change by actors in the field and the willingness of researchers to support these actors in this effort, the co-design of innovative mixed crop-livestock farming systems aims to produce useful knowledge and to transfer knowledge and know-how required by the actors to successfully carry out their plans for change (Vall *et al.*, 2016a).

In theory, co-design relies on a multi-actor framework that includes voluntary members and partners, all adhering to an ethical framework that they have themselves created in order to protect the values and objectives negotiated at the outset. In practice, we first relied on village consultation committees (Koutou *et al.*, 2011) involving diverse producers, agricultural technicians and advisers, and researchers. Having recognized the limitations of a partnership formed by locally close entities in addressing issues raised by innovation that also depend on value-chain actors located upstream or downstream of the farms and also on actors involved in territorial governance, we established innovation platforms (Dabiré *et al.*, 2016) to broaden the partnership to include the actors of the agri-chains and local authorities.

At a functional level, co-design is also based on a progressive and iterative process involving phases of exploration, implementation of change, and assessment.

In the exploration phase, we attempt to understand the concerns and expectations of actors in the field, through farm- and territory-level diagnoses to analyse producer