

Embedding Cultivated Diversity in Society

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Agroecology calls for a global approach, integrating scientific, practical, and advocacy dimensions, to redesign agricultural systems based on ecological and socio-cultural processes and emphasizing biodiversity. This review is grounded on the results of DIVERSIFOOD, an European H2020 multi-actor research project, and explores the concept of cultivated diversity using various dimensions relevant to foster sustainable organic food systems and agro-ecological transition. From the evaluation of underutilized genetic resources and forgotten crops, DIVERSIFOOD has proposed plant breeding strategies, on-farm experimentation, and statistical tools to create new populations, landraces, and organic cultivars with intra-varietal diversity. The added value of Community Seed Banks and forms of collective seed management in Europe have been described in terms of goals and activities, and their value for improving seed regulations, treaties, and genetic resources management is discussed. In the context of the current agro-food system characterized by standardization, DIVERSIFOOD raised awareness of qualities of 'biodiverse food systems' in which all actors have a role to play. It highlighted the critical capacity to preserve a diversity of cultural values embodied in 'biodiverse products', thereby involving consumers in collective strategies for reviving diversity, and empowering all actors of organic food systems to really and efficiently implement research within their farms and networks.

Keywords: agrobiodiversity ; agroecological transition ; biodiverse food systems ; participatory research ; genetic resources ; community seed bank ; organic plant breeding ; multi-actor approach

1. Introduction

Agroecology calls for an integrated and global approach of agricultural systems, embracing scientific, practical, and advocacy dimensions, aiming to redesign agricultural production systems based on their underlying ecological processes ^[1]. Agroecology proposes sustainable alternatives to the industrial agricultural model that emerged after the Second World War and the economic, social, and environmental unbalances it entails ^[2]. Whilst worldwide agricultural production based on agroecology is an achievable, yet not an easy, goal, several studies have proposed and characterized transition pathways of gradual changes in agriculture at various scales to move away from conventional-industrial systems ^[3]. Transition steps as summarized by Gliessmann ^[4] include (i) increased input efficiency, (ii) substitution of industrial inputs with alternative inputs and practices, and (iii) redesign of the system based on a set of ecological processes. These three steps, mostly focusing at a farming system scale, would ideally be integrated with two other steps aiming to (iv) re-establish connections between food users and producers and (v) a worldwide new food system instead of a linear value chain. However, this transition is far from being simple. In fact, many authors suggest that the transition is locked in the step of "increased efficiency", whereas "redesign", or "biodiversity-based agriculture", is relegated to a niche ^[5]. This is also due to a conflicting debate between an 'agroecological' vision (which is holistic) and a 'biological-science' vision (which is reductionist). The latter vision is by far dominant in EU policy, although significant openings towards more systemic and global approaches in the current decade cannot be neglected ^[6]. Furthermore, most agroecological research focuses on cropping systems management, whereas there is still insufficient explicit account for the role of seeds and genetic resources, as an integral part of agro-ecological system redesign, rather than mere inputs ^[7].

2. Embedding Cultivated Diversity in Society for Agro-Ecological Transition

There is an increasing awareness of the opportunity of biodiversity to ensure sustainable livelihoods and hence food security and nutrition. Biodiversity, at every level from genes to ecosystems, is fundamental to produce food in a wide range of ecological and socio-economic environments. It increases resilience to shocks and stresses, provides opportunities to adapt production systems to emerging challenges, and is a key resource to increase output in a

sustainable way ^[8]. In the past few years, a radical change has been called by many actors in society ^[9]. One of the key-message of the IPES (International Panel of Experts on Sustainable Food systems) report in 2016 ^[10] was “What is required is a fundamentally different model of agriculture based on diversifying farms and farming landscapes, replacing chemical inputs, optimizing biodiversity and stimulating interactions between different species, as part of holistic strategies to build long-term fertility, healthy agro-ecosystems and secure livelihoods, i.e., ‘diversified agroecological systems’.”

In Europe, the hegemony of modern varieties has reduced farmers’ and users’ knowledge and know-how in terms of plant breeding and seed production. Seed has a central role as it is an integral part of all dimensions of the agro-ecosystem. Seed incorporates two types of knowledge, the first about their biology and heredity, and the second related to the socio-cultural dimension of the societies that manage them. In fact, according to a definition proposed by the FAO (Food and Agriculture Organization), traditional knowledge can be considered an integral part of agrobiodiversity, because it is formed and preserved by human activity ^[11].

In 2014, the European Commission launched the 8th Framework Programme for Research and Innovation (2014–2020), named H2020, to support progress towards sustainable food production systems. Priority has been given to improve the use of genetic resources supporting agricultural diversity and regional products. In parallel, another concept has emerged in 2012 ‘the European Innovation Partnership for Agricultural productivity and Sustainability’ (EIP-AGRI) which has been launched to contribute to the European Union’s strategy ‘Europe 2020’ ^[12]. To achieve this aim, the EIP-AGRI brings together innovation actors (farmers, advisors, researchers, businesses, Non Governmental Organizations) and helps to build bridges between research and practice: a multi-actor and transdisciplinary research was encouraged to cross-pollinate all forms of knowledge. In this context, DIVERSIFOOD, one of the first H2020 research projects, aimed to enlarge the circle of actors committed to increasing diversity in agriculture and active management of genetic resources in local contexts.

Whilst broadening in the uses of genetic diversity for a more sustainable agricultural development is widely recognized, there is still little clarity about what shape such development should take. Agroecology offers a perspective of an all-embracing change in agricultural and food systems going beyond current technical innovations. In fact, it is only by embedding agrobiodiversity in an overall rethinking of the ecological, technological, socio-economic, and political aspects of agriculture that sustainable food systems can ultimately be developed and rooted. The DIVERSIFOOD project offered a proof-of-concept of such changes at multiple levels of the food system, including the deployment of genetic resources in farmers’ field, adoption of participatory plant breeding, collective management of agrobiodiversity at community level, and better understanding of the functioning of local, short supply chains of biodiverse products that can make the agroecological transition financially viable. Furthermore, DIVERSIFOOD has gone beyond merely implementing a multi-actor approach for a smoother application or dissemination of scientific results: it has rather prioritized a democratization of science and a reconnection between farmers’ and citizens’ initiatives and research through a collective learning and innovation process.

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