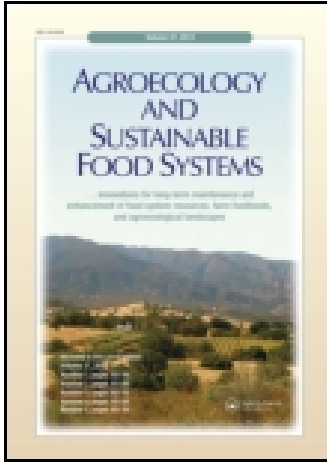


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Agroecological Research: Conforming—or Transforming the Dominant Agro-Food Regime?

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Agroecology has three practical forms—a scientific discipline, an agricultural practice, and a social movement. Their integration has provided a collective-action mode for contesting the dominant agro-food regime and creating alternatives, especially through a linkage with food sovereignty. At the same time, agroecology has been recently adopted by some actors who also promote conventional agriculture. Agroecology can play different roles—either conforming to the dominant regime, or else helping to transform it—contingent on specific empowerment strategies. Tensions between “conform versus transform” roles can be identified in European agroecological research, especially in three areas: farm-level agroecosystems development; participatory plant breeding; and short food-supply chains remunerating agroecological methods. To play a transformative role, collaborative strategies need to go beyond the linear stereotype whereby scientists “transfer” technology or farmers “apply” scientific research results. To the extent that farmer–scientist alliances co-create and exchange knowledge, such gains can transform the research system.

KEYWORDS *agroecology, knowledge exchange, research, transformation, farmer participation, agrarian-based rural development*

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1. INTRODUCTION: PROMOTING EUROPEAN TRANSFORMATION THROUGH AGROECOLOGY

In the past decade agroecology has been attracting greater interest from farmers, civil society organizations (CSOs), scientists, and other experts. Such groups linked food sovereignty with agroecology as a collective action-mode for promoting alternatives to the dominant agro-food regime. In contrast to this transformative agenda, agroecological methods also have been incorporated within the dominant agro-food regime. Such agendas include “conservation agriculture” and “sustainable intensification” as a broad framework for increasing productivity. Thus, tensions arise over the wider aims and role of agroecology—within agricultural practices, research agendas and policy frameworks.

Europe warrants greater attention in this context. Research programs there have been opening up more opportunities for agroecological research but are not always called such. Agroecological methods can be appropriated for divergent agendas, although these may not be obvious. Analytical distinctions are necessary to clarify the transformative potential of agroecological research.

Focusing on European research programs, this article discusses two main questions:

- How do agroecological research practices either conform to the dominant regime or else potentially transform it, and what are the tensions between such roles?
- What strategies can link transformation of research institutions and the dominant agro-food regime through agroecology?

After presenting analytical perspectives on agroecology and system transformation, subsequent sections analyze the following: participatory forms and roles, transformative agendas for agroecological research, and European research agendas illustrating tensions between conforming versus transforming roles. The conclusion of this article returns to the above questions.

Although most examples come from the European context, the analysis of research agendas has broader geopolitical relevance.

2. AGROECOLOGY—CONFORMING OR TRANSFORMING: ANALYTICAL PERSPECTIVES

The above questions will be explored by relating agroecology to the dominant agro-food regime, policy-landscape debates and sociotechnical transitions in general. These dynamics are next surveyed in three sections

as follows: First, agroecology has a wider transformative potential that depends on linking all its forms within a collective action mode. Second, collective-action networks linking CSOs, farmer groups, and policy experts have supported agroecology as an alternative to the dominant productivist agro-food regime. Third, agroecology can either conform to the dominant regime or else transform it, depending on specific empowerment strategies.

2.1. Agroecology: Forms and Transformative Potential

The transformative potential of agroecology depends on its specific forms. Some have identified three meanings or forms of agroecology—as a scientific discipline, an agricultural practice, and a social movement (Wezel et al. 2009). More profoundly, its practice is interdisciplinary (Buttel 2003). Its knowledge is transdisciplinary, integrating diverse knowledge systems—for example, scientific, experiential, local, indigenous, etc.—within a problem-based focus (Méndez et al. 2013). A transformative role for agroecology depends on integrating its three forms in practice—transdisciplinary knowledge, interdisciplinary agricultural practices, and social movements—while recognizing their mutual dependence.

Initially a focus on ecological science limited agroecology to a marginal role within the research and agricultural systems. An early reference point was low external input sustainable agriculture (LEISA), which sought the following: to optimize and balance nutrient flows; minimize the use of nonrenewable external resources (fertilizers, pesticides, and fuel); maximize the use of renewable resources (solar energy, biomass, and hydropower); enhance genetic diversity; and promote ecological processes and services. These elements were appropriated for the five principles of agroecology (Altieri 1995).

Although meant as a critique of the dominant agro-food regime, those strictly ecological principles have enabled some supporters to neglect the wider socioeconomic dimensions motivating the rise of agroecology. Its ecological principles have been more recently articulated with sociopolitical ones (Stassart et al. 2012, *forthcoming*). In the past decade, agroecology has been promoted an alternative to the agricultural modernization project, alongside efforts at promoting food sovereignty (e.g., Yale Institute of Social Studies 2013).

For a long time, agroecology has been mobilized for transforming the wider agro-food system. In the 1990s,

agroecology as a scientific discipline went through a strong change, moving beyond the field or agroecosystems scales towards a larger focus on the whole food system, defined as a global network of food production, distribution and consumption. (Wezel et al. 2009: 3; see also Gliessman 2007)

This broader perspective has facilitated links with farmer organizations, consumer-citizen groups and social movements supporting alternatives to the dominant productivist agro-food regime.

Agroecosystems have become a central concept. As a science, agroecology is the “application of ecological science to the study, design and management of sustainable agroecosystems” (Altieri 1995). Agroecological methods depend on and enhance functional biodiversity, both within and near agriculture, thus, together promoting integrated agroecosystems (Kremen et al. 2012). By contrast to “the farm as a factory,” ecological concepts help to reconceptualize “the farm as a managed, harvested ecosystem,” including the wider environment, rather than relegate any environmental harm to “externalities” (Weiner 2003: 373). An agroecosystems perspective helps to identify techniques for transforming practices from chemical-intensive monocultures: “Even the more modest incremental approach still involves issues worthy of agroecological research, particularly if there are important interactions and thresholds in the transformation of agricultural production systems” (Tomich 2011: 211).

Going beyond agroecology as natural science and farm-level practice, a societal mobilization can transform the agro-food system. The presence of alternative distribution systems and the diversity of social institutions and economic relations in agriculture, such as farmer’s markets, community-supported agriculture, cooperatives, and production for both subsistence and sale, offer several important incentives that can be coupled with an enabling policy environment (Iles and Marsh 2012).

Thus, policy changes and societal mobilization are necessary for processes empowering actors to transform the dominant regime. Such transformation depends on several socioeconomic principles, for example:

Generate collective knowledge and adaptability through networks involving producers, consumer citizens, researchers, and government technical advisors to foster forums for deliberation, public debate, and the dissemination of knowledge.

Foster the possibilities for choosing autonomy from the global markets by creating a propitious environment for public goods and the development of socioeconomic practices and models that reinforce the democratic governance of food systems.

Use diverse skills and knowledge . . . in constructing both the issues and the publics concerned by these issues, as well as in seeking solutions. (Stassart et al. [forthcoming](#))

Together these strategies can empower agroecology through political ecology approaches, by strategically intervening in the power dynamics and institutions that comprise agro-food systems (de Molina 2013; Méndez et al. 2013).

2.2. Agroecology within Sociotechnical Transitions

Since the 1970s, the dominant agro-food regime has become a market-driven system whereby agro-industrial methods maximize yield and generate surpluses, for which subsidy gains global export, in turn undermining productive capacities and less-intensive methods elsewhere; thus, the regime pushes farms everywhere to adopt intensification methods. In this dominant regime, “agrofood corporations are the major agents attempting to regulate agrofood conditions, that is, to organize stable conditions of production and consumption which allow them to plan investment, sourcing of agricultural raw materials, and marketing” (Friedmann 2003: 52). By encompassing policy-regulatory frameworks, the agro-food regime concept is broader than “regime” in the general theory of sociotechnical transitions.

“Regime” there denotes routines and capabilities, corresponding to sociotechnical rules (Geels 2010). Sociotechnical transitions from an incumbent regime to a new one have been theorized in various ways (Geels and Schot 2007; Lachman 2013). The multilevel perspective (MLP) explains transitions within three interacting levels, namely: “niches (the locus for radical innovations), socio-technical regimes, which are locked in and stabilized on several dimensions, and an exogenous socio-technical landscape” (Geels 2010: 495).

In this theoretical model, niches are protective spaces for innovations. These may be selected, protected or marginalized by regimes. “Within this protective space, niche actors can nurture the path-breaking innovation so it becomes more robust through performance improvements and expansions in supportive sociotechnical networks” (Smith and Raven 2012: 1025).

Agroecology has diverse potential roles and futures, which can be illuminated by the MLP’s tripartite model at the regime and landscape levels. Civil society organizations and farmers’ movements have together developed political agendas seeking to transform agro-food regimes as selection environments for agroecology in various ways, as briefly sketched here.

Since around 2000, European civil society and farmers’ movements have increasingly discussed agroecology as a strategy and collective action-mode. In parallel, the “counter-globalization” movement was developing North–South networks through movements as well as CSOs. In particular, Via Campesina (2013) advocates “transforming the food system based on the principles of agroecology, agrarian reform and food sovereignty” (38). From such origins in political struggles, European promotional efforts for agroecology have been inspired by higher-profile, large-scale initiatives in the global South. Agroecology there has been elaborated within a re-peasantization process among rural social movements. “For peasants and family farmers and their movements, agroecology helps build autonomy from unfavorable markets and restore degraded soils, and social

processes and movements help bring these alternatives to scale” (Rosset and Martínez-Torres 2012: 17).

Such links between agroecology and peasant struggles have been promoted and analyzed in Europe (e.g., Van der Ploeg 2009; Sevilla Guzmán and Woodgate 2013). Such linkages arise from the experiential knowledge of North–South activist networks: “agroecology is a strategic part in the construction of food and popular sovereignty,” argues La Via Campesina (Surin Declaration 2012). Its European coordination further declares, “Agroecology as understood by social movements is complementary and inseparable from food sovereignty we want to build” (European Coordination Via Campesina 2013). Such networks had already promoted sovereignty as “the right of peoples to define their own food, agriculture, livestock and fisheries systems” (Nyeleni Europe 2011) rather than the food supply being largely subject to international market forces. European farmer organizations and nongovernmental organizations (NGOs) envisage agroecology as central to a food sovereignty paradigm developed first in the global South through networks of food providers, for example, farmers, pastoralists, urban farmers, indigenous peoples, food workers, fisherfolk, small-scale food processors, and artisans (FoodSovCap 2010; Nyeleni Europe 2011).

European social movements and CSOs have increasingly linked agroecology with food sovereignty for a transformative agenda (e.g., Hilmi 2012). A broad farmer–CSO coalition links “agro-ecological innovation” with food sovereignty: “the solution lies in a high degree of self-sufficiency and food sovereignty at local, regional, national or continental level,” where people have “the right to establish their own agriculture and food policy” (ARC2020 2012).

From that perspective, agroecology can stretch-and-transform the dominant agro-food regime, thus, contesting and potentially reversing the commodification of nature (Desmarais 2007; Holt Giménez 2011; Pimbert 2009a).

Likewise, intervening in the policy landscape, official expert studies have promoted agroecology, especially by highlighting farmers’ knowledge and innovation which lack official recognition as such (e.g., International Assessment of Agricultural Science, Technology and Development [IAASTD] 2008). According to the EU’s Standing Committee on Agricultural Research, agricultural improvements have arisen through social-experimental processes linking farmers, agronomists and citizens’ groups: there are “ongoing experiments” (“novelties”) and a re-development of knowledge networks” (Standing Committee on Agricultural Research, Foresight Expert Group [SCAR FEG] 2008: ii). Agroecology should be given priority, according to a subsequent expert report:

Approaches that promise building blocks towards low-input high-output systems, integrate historical knowledge and agroecological principles that

use nature's capacity and models nature's system flows, should receive the highest priority for funding. (SCAR FEG 2011: 8)

The report linked agroecology with a sufficiency perspective, counterposed to the dominant productivist one.

In an EU policy context emphasizing innovation, mainly meaning capital-intensive technology (e.g., Commission of the European Communities [CEC] 2010), agroecology has been promoted as a different kind of innovative practice. It combines four types of innovation—know-how, organizational, social and technological—each type integrating farmers' knowledge (International Federation of Organic Agriculture Movements [IFOAM] EU Group et al. 2012). A farmer–CSO alliance has likewise advocated agroecological innovation (ARC2020 et al. 2012). These initiatives challenge at once the dominant models of innovation and agriculture. Discussion of agroecology within international policy circles has been stimulated by the U.N. Special Rapporteur on the Right to Food (De Schutter 2010; De Schutter and Vanloqueran 2011).

Extra impetus for incorporating agroecology has come from the global policy aim to increase agricultural productivity, especially since the 2007–2008 food crisis (Food and Agriculture Organization of the United Nations [FAO] 2009a). Beyond the temporary price spike, this crisis highlighted long-term agricultural problems: higher energy costs, competing land uses, greenhouse gas emissions (GHG), resource burdens, and other environmental harms. An incipient neo-productivist paradigm faces the challenge to locate the environmental sustainability and resilience of national food-supply systems within current globalization patterns (Marsden 2012: 307).

In that context, the term “agroecology” has been recently adopted by some actors who also promote conventional agriculture—for example, agrochemical companies (Syngenta et al. 2006), McDonald's (2011), and some governments. When France declared its aim to lead agroecology in Europe (Ministre de l'Agriculture de l'Agroalimentaire et de la Forêt 2013), this appropriation was publicly contested. According to a network of CSOs and farmers, the government proposes a “form of agroecology very distant from what we hope to see promoted for our agriculture,” for example, by promoting no-till methods with herbicide sprays (Fédération Nature & Progrès 2013 [our translation]).

2.3. Agroecology: Different Empowerment Strategies

What is the potential for agroecology to transform the dominant agro-food regime? From within the multi-level perspective, Smith and Raven (2012) argue that an innovation may have different empowerment strategies—either to fit and conform to the dominant regime, or else to stretch and transform it:

Fit-and-conform empowerment makes the niche innovation competitive with mainstream socio-technical practices in otherwise unchanged selection environments. An innovation that is originally perceived as potentially path-breaking becomes incremental in terms of its broader socio-technical implications . . .

In stretch-and-transform empowerment, innovations aim to undermine incumbent regimes and transmit niche-derived institutional reforms into re-structured regimes. Niches influence their selection environments. . . . (Smith and Raven, 2012: 1030)

Specific arenas are more conducive to one strategy or the other. The two strategies are “exercised in contrasting arenas, with potentially very different outcomes in terms of form and function of the emerging socio-technical system, who holds control and what sustainability criteria are maintained.” Conforming strategies seek to persuade dominant institutions so that the innovation eventually can become competitive without long-term external support. By contrast, “transform” strategies attempt to change the dominant regime’s selection pressures and sustainability criteria, especially by persuading those social groups which would most benefit (Smith and Raven, 2012: 1030).

How do those different empowerment strategies relate to agroecology? Its role depends on which action-networks are being empowered and across what scales. Table 1 distinguishes between different empowerment strategies for conforming versus transforming the dominant agro-food system.

Illustrating a “conform” role, some agroecological methods have been selectively appropriated to fit intensive agricultural models, attempting to avoid chemical inputs while also maintaining productivity. Many bio-inputs have become commoditized, thus, continuing farmers’ dependence on input suppliers. In such ways, organic farming has been conventionalized in some places (Darnhofer et al. 2009; Stassart and Jamar 2008). Monoculture forms substitute biological or organic inputs for chemical ones, thus, imitating conventional methods and their dependence on external inputs. Formerly a niche market, biopesticides are being mainstreamed by multinational companies that generally sell agrochemical inputs.

Some agroecological methods also have been incorporated into “sustainable intensification.” This has become an umbrella concept linking agroecological and other methods to increase yield, while also lowering the burdens on land and natural resources. The concept was initially directed at the global south as follows:

Major areas of focus will include pro-smallholder seed systems at national scale, integrated pest management, conservation agriculture, access to and sustainable use of plant genetic resources, and better management

TABLE 1 Empowerment strategies for agroecology (first column based on Smith and Raven 2012)

Strategies	Conform	Transform
Political agency		
Local-global agency, empowerment of protective spaces	Agroecological practices being appropriated within a broader range of farm-level techniques for “sustainable intensification.”	Agroecological methods signaling the need to develop mixed farming, to enhance wider ecosystems and to transform agro-food markets.
Discursive process to enable institutional reforms	Farm advice-extension services facilitating moves from intensification via external inputs to the intensification of agro-ecosystem resources, within the same system boundaries.	Stakeholder action-networks demanding multi-level institutional change in decision-making processes, agri-subsidy criteria, seed-variety rules, land tenure. System boundaries are broadened beyond farm-level practices to transform the entire agro-food system.
Narratives: Stories linking the present with a desirable future	Narrative: Through technological advance, agroecological–organic methods could better compete with the productivity of conventional methods and/or could alleviate their environmental problems.	Narrative: Agroecological methods should set the standard for reshaping all agriculture (e.g., around farmers’ knowledge, eco-innovation, wider ecosystems, etc.) within a broader perspective on food sovereignty and sufficiency.

of soil and other crop associated biodiversity, while reducing soil, air and water pollution. (FAO 2009b: 19)

The concept has been extended for global relevance:

... we must aim for sustainable intensification—the production of more food on a sustainable basis with minimal use of additional land. Here we define intensive agriculture as being knowledge-, technology-, natural capital-, and land-intensive. The intensity of use of non-renewable inputs must in the long term decrease. (The Royal Society 2009: 46)

To minimize nonrenewable inputs, intensive methods should include “agroecological processes such as nutrient cycling, biological nitrogen fixation, allelopathy, predation and parasitism,” alongside other options such as genetically modified (GM) crops (Royal Society 2009: 17). Along such lines, agroecological methods have been incorporated into sustainable intensification. By appropriating agroecological methods for productivist aims, the concept sustainable intensification blurs the distinction between

an agroecological agenda and Green Revolution capital-intensive agenda (Holt-Gimenez and Altieri 2013).

Rather than play a conform role, agroecological practices can help to overcome dependence on external inputs (Rosset and Altieri 1997). Such practices have a much broader role beyond organic agriculture. Through an “organification” strategy, some conventional farmers have sought to improve environmental sustainability through agroecological methods (Rosin and Campbell 2009). Agroecological production methods offer a qualitatively different product, generating many environmental benefits. Agroecological farm-level experiments have various levels of protection from the dominant agro-food regime. For agroecology to be economically viable, CSO–farmer alliances have promoted various support measures, which include: circuits courts (short food chains), quality or certification labels (e.g., based on territorial identity), farmers’ knowledge-networks, public procurement criteria for food localization, etc. Such measures can benefit the organic sector as well as agroecological methods more generally.

Conform versus transform tensions arise in various arenas, perhaps more subtly in the research arena. Despite the rising European interest in agroecology, the agro-industrial productivist model remains dominant in research agendas. They have favored a biotechnological paradigm over an agroecological paradigm. Moreover, a combination of factors has generally locked in biotech, while locking out or excluding agroecology. “The issue is thus how to break out of this lock-in situation, as incremental progress is just not enough . . .” (Vanloqueren and Baret 2009: 980).

To break the lockout of agroecological research and to give it a transformative role, there is need for participatory research combining the science of dynamic complexity with the knowledge of farmers in local contexts, as urged by expert reports (e.g., IAASTD 2008; SCAR 2011). Participatory agroecological research can either “fit and conform with” or else “stretch and transform” the dominant research paradigm. Likewise various research agendas can serve either strategy. Crucial is the opportunity and capacity for collective involvement in shaping research agendas.

3. RESEARCH PARTICIPATION: QUALITY AND FORM

To play a transformative role, collaborative strategies need to go beyond the research arena and its scientific institutions. Beyond the linear stereotype whereby scientists “transfer” technology or farmers “apply” scientific research results, a participatory knowledge exchange has already been happening among farmers and with some agroecological scientists (Méndez 2013). Farmer–scientist cooperation has been promoted as a crucial means for agroecological knowledge exchange and development (e.g., Uphoff 2001; ARC2020 et al. 2012). Their cooperation is “vital for the success of

agroecological practices” (De Schutter 2010: 14). Such strategies have been advocated by farmers’ networks in Europe: Agroecological knowledge production “can be carried out only in liaison with peasant movements which use agroecology,” argues the Réseau Semences Paysannes (RSP; 2008 [our translation]).

To the extent that farmer–scientist alliances gain research funds based on knowledge-exchange processes, such gains can transform the agri-research system. This shift requires deep institutional reforms, including changes in funding procedures and research organization (EU SCAR 2012). But such efforts run up against institutional limits of agricultural research institutes and state funding bodies, especially their modernist–productivist agendas, reward structures, and short-term grants (see Petersen et al. 2013, on Brazil).

Several European initiatives in agroecological research and plant breeding have described themselves as participatory in their promotional materials and funding applications. However, there is a need to distinguish among the different kinds of participation in each case, for example, ranging from passive to more active forms (Pretty 1994). When analyzing various kinds of participatory agroecological research, it is important to look at the whole research and development cycle (Pimbert 2011). Participation can occur in four key moments or stages:

- i. evaluations of results and impacts of research, including risk and sustainability assessments;
- ii. scientific and technological research—the production and validation of knowledge in the natural and social sciences;
- iii. the choice of upstream strategic priorities and funding allocations for research and development (R&D);
- iv. the framing of science and agricultural development policies.

Participatory methods and deliberative processes that genuinely include different actors are important in opening up the entire agroecological research cycle to greater citizens’ oversight and democratic control over what knowledge is produced, for whom, how, where, and with what likely effects. Various methodological approaches and processes can be used to facilitate direct participation of farmers and consumer–citizens in different stages of the R&D cycle (Pimbert 1991; Chambers 1992, 1993; Pretty and Chambers 1993; Pimbert et al. 2011, Salas 2013; Pimbert and Wakeford 2001).

A focus on the entire R&D cycle allows for a shift from narrow concepts of participatory agroecological research that confine non-researchers (farmers, food workers, consumer–citizens) to “end of the pipe” technology development (e.g., participatory technology development) to a more inclusive approach in which farmers and other citizens can influence the

upstream strategic priorities of research and the overarching policies on agri-food research. These dynamics have great variations, for example, depending on whether participation is used to justify external decisions and control by powerful actors or whether it devolves decision making away from external agencies, thereby rebuilding local assets and peoples' food sovereignty.

By including more people and places, a participatory dynamic challenges research and extension organizations to become flexible, innovative and transparent. Diversity, decentralization, and devolution of decision-making powers implies organizational cultures going beyond standardized criteria and practices (Pimbert 2004). Fundamental changes in the organization of research are necessary so that its policies, programs, operational procedures, resource allocation, and projects facilitate participation, alongside the adaptive management of agroecosystems (Pimbert 2009b).

4. TRANSFORMATIVE AGENDAS FOR AGROECOLOGICAL RESEARCH

Transformative agendas for agroecological research are championed mainly by the food sovereignty movement in Europe and elsewhere. This movement seeks to develop more autonomous, participatory ways of producing knowledge that is ecologically literate, socially just and relevant to context and dynamic complexity. This implies a radical shift from the current top-down, increasingly corporate-controlled research system, to an approach which devolves more responsibility and decision-making power to farmers and citizens for the production of social and ecological knowledge. More specifically, there have been two complementary approaches to transforming knowledge and ways of knowing for agroecology and food sovereignty (Pimbert 2009b), as follows:

1. Democratizing public research and increased funding for participatory agroecological research. This implies a systemic transformation within the existing educational and research establishment. It entails deep changes in academic cultures, in the self-image of researchers and academics, in teaching pedagogies, in research agendas and methodologies, organizational cultures, operational procedures, and in the very role that universities and research institutes play in European societies (Pimbert 2009b). Methodological and institutional innovations are being developed in a variety of settings to help broaden democratic control over existing public research institutions and universities in order to transform theory and practice (e.g., see www.excludedvoices.org). Policy recommendations made by farmer and citizens' juries on the governance of agricultural research often focus on changing the determinants of innovation and factors that influence research choices, for example, science

- policies, public–private partnerships, funding, and ways of working of scientists (Pimbert et al. 2011; Pimbert et al. *in press*).
2. Support bottom-up agroecological research for autonomous learning and action. This requires the strengthening of farmer- and citizen-led innovation and sociocultural networks that are organized along more horizontal and egalitarian lines to produce and transform knowledge, with or without the involvement of professional scientists. The Réseau Semences Paysannes in France exemplifies this approach to agroecological research and participatory plant breeding (www.semencespaysannes.org). Examples from other continents include: the Campesino a Campesino movement in Central America (Holt Giménez 2006); action research on sustaining local food systems, biodiversity, and livelihoods in South India, Peru, Iran, and Indonesia (Fakih et al. 2003 Pimbert et al. *in prep.*); “phenomenon-based learning,” which engages students in an innovative pedagogical model for agroecological teaching and learning in real-world situations (Francis et al. 2011; Francis et al. 2013); and the social process methodology used in constructing sustainable peasant agriculture and food sovereignty in Cuba (Rosset et al. 2011).

For both these approaches, developing more power-equalizing agroecological research is an important aim. Such research involves both researchers and non-researchers in close cooperative engagement, jointly producing new knowledge, with mutual learning from the process. A key challenge is how to give non-researchers (farmers, food workers, citizens consumers—both men and women) more significant roles than before in the production and validation of agroecological knowledge. This transformative agenda implies a significant reversal from dominant roles, locations, and ways of knowing.

When combined, the following practices generate more power-equalizing, transformative research (Pimbert 2012a; Pimbert *in press*):

- ensuring that non-researcher participants have an opportunity to assess the desirability and relevance of engaging in cooperative research activities, exercising their right to free prior informed consent and to co-define the terms of engagement with scientists;
- forming safe spaces for participatory learning and action;
- ensuring greater cognitive justice between fundamentally different knowledge systems and ways of knowing;
- creating an “extended peer community” whereby researchers and non-researchers co-validate knowledge produced through participatory research on agroecology for sustainable food systems.
- communicating agroecological research findings in open, accessible, decentralized and democratized ways.

Agroecological research for transformation is, thus, part of a bottom-up, participatory process in which farmers and citizens take center stage. They become centrally involved in both the “upstream” choice and design of scientific innovations, and their “downstream” implementation, spread and regulation. These empowering processes are complex, messy, and difficult for those seeking transformation (Bacon et al. 2013; Noorani et al. 2013).

The stretch and transform version of participatory agroecological research differs from the fit and conform research practices. A transformative agenda democratizes research, diversifies forms of co-inquiry based on specialist and non-specialist knowledge, expands horizontal networks for autonomous learning and action, and creates more transparent oversight in the production and validation of knowledge (Cuéllar-Padilla and Calle-Collado 2011; Pimbert 2006). This participatory process creates new possibilities to transform knowledge for food sovereignty and human well-being (Kloppenber 1991; Pimbert 2009b).

A reinvigorated political democracy alone cannot ensure that agroecological research serves the public good. Widening economic democracy is another key condition for mainstreaming citizen participation and deliberative democracy in transformative agroecological research. More specifically, there is a need for policies that offer enough material security and time for farmers and citizens to exercise their right to participate in shaping agroecological research for the public good in Europe (Pimbert 2009a).

5. EUROPEAN AGROECOLOGICAL RESEARCH: TENSIONS BETWEEN APPROACHES

Agroecology remains generally implicit in European research agendas, so their content and potential roles warrant analysis. Amongst the broad range of agroecological research topics, some approaches more readily fit the dominant agro-food regime, while other approaches more readily complement farmer participation and agrarian-based rural development for wider transformative roles. These roles, and tensions between them, can be analyzed according to the concepts in Table 1.

Tensions have arisen especially within the European Innovation Partnership on Agricultural Productivity and Sustainability (EIP-Agri). Developing a multiactor approach, the EIP-Agri represents all relevant stakeholder groups in the agri-innovation area. So representatives express divergent agro-food visions, for example, monoculture versus agroecosystem contexts for lowering external inputs. In this forum, CSO networks have promoted and highlighted opportunities for empowering agroecological practices:

Associations for agroecological farming should take advantage of the opportunities offered and convince their national or regional authorities to implement the EIP-Agri and set-up operational groups fostering organic and agroecological solutions. (TP Organics and IFOAM-EU 2014: 16)

Agroecological research and its transformative role depend on participatory processes in agenda-setting. Technology Platform Organics has organized stakeholder consultations on how to formulate and prioritize research proposals (ARC2020 et al. 2012). These proposals incorporate stakeholders' problem-definitions reflect researchers' capacity to carry out cooperative projects and build longer-term collaborations; many have been incorporated into EU research agendas.

This section analyses conform versus transform tensions arising in European agroecological research, especially in three areas: farm-level agroecosystems development; participatory plant breeding; and short food-supply chains remunerating agroecological methods.

5.1. Farm-Level Agroecosystems Development

Research for a transformative agroecology has sought to overcome farmers' multiple dependence—on monoculture systems, input-substitution, external-input markets, and costly biotechnology packages. Independence has been sought through integrated agroecosystems (Rosset and Altieri 1997). Agroecological methods depend on resource availability from local agroecosystems, in turn dependent on environmental protection, market structures, territorial development strategies, interventions by social movements, etc. (de Molina 2013). Agroecological methods also depend on resource recycling across production processes through “virtuous circles” and circular economy models. These more closely link food and energy production with water and waste management at different scales—from urban neighborhoods to rural landscapes (Jones et al. 2012; Pimbert 2012b).

Through a functional biodiversity within and around agroecosystems, synergies provide ecological services, recycle nutrients and enhance natural enemies of pests—thus, reducing external inputs—as agroecological means to provide diverse, quality foods and other farm products. This approach can include some input substitutions, for example, micro-wasps controlling maize pests instead of spraying hazardous synthetic insecticides.

But an overemphasis on better external inputs imitates conventional agriculture, while ignoring wider agroecosystems whose resources are being degraded through market pressures, public policies, etc. (de Molina 2013). Some research seeks intensification methods within an imitative input-substitution strategy. Examples include: testing higher-density monocultures for pest problems and preventive measures, testing the few chemical inputs

permitted for organic certification, testing biological substitutes, developing better substitutes, etc.

Tensions between different approaches are illustrated by France, where agroecology has been explicitly supported by the Ecology Ministry as well as the National Institute of Research in Agriculture (INRA). According to its orientation document for 2010–2020, agroecology must take into account biological diversity at all levels of organization and functionality to understand the dynamics of life and its role in ecosystem services provided by agro-ecosystems (INRA, 2010).

Through an interdisciplinary approach, INRA undertakes to “mobilize advances in biology, biotechnology and agroecology,” while linking agroecology with genetics and predictive biology (INRA 2010: 16–17). It also mentions intensification of agricultural practices, for example, via innovation of crop varieties. These aspects echo the hybrid approach of sustainable intensification (Royal Society 2009, as cited in INRA 2010).

In parallel, INRA’s Science for Action and Development (SAD) unit has elaborated principles for agroecological research, for example:

Facilitate and equip the multi-factoral management of agroecosystems for their long-term transition. This means arbitrating between short and long time scales and giving importance to the properties of resiliency and adaptability.

Make use of resources’ spatial and temporal variability (diversity and complementarity), i.e., use local resources and characteristics and work with diversity and variety rather than trying to free oneself from them.

Stimulate the exploration of situations that are far from already-known local optima, e.g., “extreme” systems with very low levels of inputs and/or biological yields in livestock farming and cropping alike. (Tichit and Bellon 2010; for similar principles of animal production, see Dumont 2013)

That perspective links cultivation methods and their biodiversity basis with agroecosystems. For a transformative agenda, the SAD principles have been supplemented by aims to “Promote the development of participatory research,” as well as to “generate collective knowledge and adaptability through multi-actor networks” (Stassart et al. 2012, *forthcoming*). This extra principle highlights the aim for farm-level agroecosystems to empower farmers and other practitioners towards transforming the agro-food regime (see Table 1).

As an agroecological response to the low-productivity problem, Technology Platform Organics devised the novel concept “eco-functional intensification,” linked with farmers’ knowledge as well as scientific research. The concept intervened in discussions on the EU agri-research agenda by providing an alternative to “sustainable intensification.” Eco-functional intensification means

more efficient use of natural resources, improved nutrient recycling techniques and agro-ecological methods for enhancing diversity and the health of soils, crops and livestock. Such intensification builds on the knowledge of stakeholders using participatory methods . . . [It means] activating more knowledge and achieving a higher degree of organization per land unit. It intensifies the beneficial effects of ecosystem functions, including biodiversity, soil fertility and homeostasis. (Niggli et al. 2008: 34).

Eco-functional intensification is illustrated by resource conservation and recycling, going beyond bio-input substitutes:

Diversified land use can open up new possibilities for combining food production with biomass production and on-farm production of renewable energy from livestock manure, small biotopes, perennial crops and semi-natural non-cultivated areas. Semi-natural grasslands may be conserved and integrated in stockless farm operations by harvesting biomass for agro/bio-energy and recapturing nutrients from residual effluent for use as supplementary organic fertilizer on cultivated land. (Schmid et al. 2009: 26).

In such ways, renewable inputs and agro-biodiversity can be linked across scales to the wider landscape. All the above research topics indicate a potential for agroecological practices to empower farmers, enhance agroecosystems and transform agro-food systems, rather than fit the dominant agro-food regime.

5.2. Participatory Plant Breeding

In 2003, the RSP (the Peasant Seeds Network) was created in France by the Confederation Paysanne, the National Coordination of Defenders of Farm Seeds, and several organic farmers' associations. The RSP consists of 50 member organizations and builds on the earlier work of French seed savers, focusing on vegetables, fruit, cereals, oilseeds, and grapevines. Members have initiated their own plant breeding based on traditional crop varieties. Since 2003 the RSP has worked with a small group of plant breeders and agroecologists from INRA. Participatory plant breeding has so far focused on wheat, maize, and crucifers.

For participatory plant breeding (PPB), the co-inquiry process between French scientists and the RSP has generated several tensions, as well as new opportunities for meaningful change. In sharp contrast with mainstream science, the RSP farmers reject the reductionist, utilitarian and mechanistic view of the living world, as in the quantifying-instrumental approach

of conventional plant breeding. They value a holistic agroecological and phenomenological understanding of reality.

Consequent difficulties are illustrated by efforts at long-term knowledge exchange between French agronomists and peasants. Although they have common thematic interests in agroecological practices, research cooperation has faced many obstacles. For example, French peasants have difficulty finding researchers who can respond to their questions. Either no researchers work on such questions, or else researchers are unwilling to exchange knowledge with peasants. Conversely, many peasants are unwilling to cooperate with scientists (Neubauer and Piasecki 2009, 2010; cited in Levidow and Oreszczyn 2012).

Researchers may want to involve farmers but face many barriers—or even create them. In many cases, the research design has been unnecessarily complex, perhaps in order to seem sufficiently scientific to commercialize or to publish in specialist journals. Often calls for project proposals are effectively calls for results; an applicant must nearly know in advance the results of the research, and there is an imperative to publish such results soon in specific journals (Neubauer and Piasecki 2009, 2010; cited in Levidow and Oreszczyn 2012).

The RSP's perspective has generated tensions when working with well-meaning researchers from INRA, whose language reflects an instrumentalist view of nature. Many male INRA scientists have remarked that PPB in an agroecological context is not sufficiently valuable or important for their career advancement. Collaboration with the RSP attracts only female scientists (Pimbert 2011).

This minority of women scientists see the necessity of an alternative research paradigm. They develop science for greater understanding of diversity, adaptation and evolution. Although they may use quantification and reductionist methods, these are meant as contributions to a more holistic understanding and insight into the intrinsic beauty of how nature works. Their minority attitude can facilitate epistemological convergence and meaningful knowledge-exchange between scientists and farmers (Pimbert 2011).

Those participatory initiatives are illustrated by an European Union's Framework Programme 7 project, "Strategies for organic and low-input integrated breeding and management" (SOLIBAM). This multi-stakeholder project sought to promote diversification of crop varieties, as a component of "innovative arable and vegetable cropping systems based on a high level of agrobiodiversity (diversification in crop species, management and habitat, coupled with use and development of genetically diverse germplasm)." As a problem addressed, PPB has been sometimes conducted with the same methodologies used to assess conventional plant breeding, for example, an area planted with a variety extrapolated from certified seed, thus, losing the special benefits of PPB.

To overcome that limitation, the Solibam project created novel diversity within a range of species and developed existing diversity within species (Solibam 2013a). Traditional landraces and old varieties were initially characterized for their agronomic performance, quality and organoleptic properties. Such varieties were selected and intercrossed through two different breeding strategies—farmers created new populations, and breeders created F1 hybrids (i.e., the first offspring of distinctly different parental types)—thus, creating composite cross populations (Sciences Citoyennes 2012; Solibam 2013b). After sowing the progeny in the field, the crosses were compared with results from landraces. Several field trials tested whether three generations of on-farm selection can produce a variety closer to the breeding goal of local farmers (Solibam 2013a). Such goals include climate-resilience and higher productivity with minimal external inputs, which can be enhanced by an appropriate heterogeneity (Bocci 2014).

Under a strict interpretation of the law, seed populations may be bred only for research purposes and farmers' own cultivation; seeds must gain certification in the statutory seed catalogue before exchanging or multiplying them for commercial use. Taking up peasants' demands, a previous project had proposed a Europe-wide informal seed system for improving diversity and stimulating local innovation, as a basis to gain recognition for peasant-bred seed populations, which would still remain outside the seed catalogue. These efforts toward farmers' rights were continued by the Solibam project (Bocci et al. 2011; Chable 2012).

To facilitate cooperation between peasants and researchers, a civil society organization attempted to identify and overcome barriers. Its research project formulated recommendations and notably a book on peasant visions for research in PPB (Sciences Citoyennes 2012). The project linked co-piloting of research and civil society participation in producing ecologically useful knowledge.

5.3. Short Food Chains

Over the past decade, Europe has seen more initiatives for closer proximity between food producers and consumers. These are variously known as alternative agro-food networks, short food-supply chains (circuits courts), or agro-food relocalization. Such initiatives are necessary to incentivize and remunerate agroecological methods through consumer support, especially for farmers lacking the premium price of organic-certified products. More ambitiously, such networks can empower new citizen–community alliances, as a counter-weight to the dominant agri-food system and its competitive pressures (Fernandez et al. 2013).

Some European research on this topic has been co-constructing knowledge through exchanges among diverse stakeholders involved in

transforming agro-food systems. Within the European Union's Framework Programme 7 project, two projects drew lessons from such initiatives in order to facilitate their wider development. Both projects identified citizens' groups promoting greater social proximity between farmers and consumers. Both projects also recommended policy changes which could help strengthen such links, as explained below.

Facilitating Alternative Agro-Food Networks (FAAN) analyzed several networks building consumer support for agri-food methods which minimize external inputs and enhance aesthetic food qualities, among other benefits. Many farmers pursue regimes which aim to preserve the environmental quality of landscapes; they maintain agro-biodiversity by preserving local traditions and varieties. Although most initiatives started by marketing organic products, this base expanded opportunities for agroecological methods more generally to gain better remuneration (Karner 2010). Tensions arise in empowering agroecological practices in new markets, especially when supermarket chains expand "organic" and "local" product lines. So farmers have established collective marketing initiatives, in order to retain their specific product identities, proximity to consumers and the value added, for example, in Cumbria case (Levidow and Psarikidou 2011).

As a special feature of the FAAN project, each national team combined a partner from an academic institution and from a CSO already engaged in the issues. The CSO partner brought together knowledge and participation from relevant stakeholder groups, especially for scenario workshops. The project also identified numerous policies hindering or facilitating local food systems, as a basis for recommending policy changes (Karner 2010). These changes have been promoted by the CSO partner's networks, thus, potentially empowering them in policy arenas. Using the research outcomes from similar projects, the Brittany partner persuaded municipalities to adopt measures which help link urban consumers with agri-producers minimizing resource burdens (Maréchal and Spanu 2010).

Another FP7 project, "Food Links: Short Food Supply Chains as Drivers of Sustainable Development" surveyed linkages between short chains, agroecological practices (traditional, organic, extensive, pasture-based systems, etc.) and lower external inputs, especially agrochemicals. In addition to the profit motive, the project identified actors' self-determination and self-esteem as a motive for participation. The numerous case studies included Les Bons Repas de l'Agriculture Durable (BRAD) in Brittany, where a citizen-led certification scheme has evaluated whole-farm sustainability. Farm visits are made by an agronomist, the first to collect data and the second to give feedback and negotiate a progress agreement with the farmer (Galli and Brunori 2013). These practices generate a commitment to continuous improvement, rather than a priori criteria for certification.

Drawing on diverse experiences of shortening food chains, the Food Links project made recommendations for policy changes, especially aimed to

facilitate social cohesion. It advocated stronger social considerations in public procurement policies. Likewise urban planning and infrastructure policies must go beyond commercial criteria (Galli and Brunori 2013).

6. CONCLUSION: AGROECOLOGY CONFORMING VERSUS TRANSFORMING?

Agroecology historically has been defined as the application of ecology to agricultural systems. From a transformative perspective, agroecology has three practical forms—a scientific discipline, agricultural practices and social movements. Their integration has provided a collective-action mode for contesting the dominant agro-food regime and creating alternatives, especially through linkages with food sovereignty.

At the same time, agroecology is becoming a new buzzword, perhaps analogous to sustainable agriculture in the 1990s. The term “agroecology” has been recently adopted by some actors who also promote conventional agriculture. Therefore, it is important to clarify the different potential strategies for upscaling agroecology. It can play different roles—either conforming to the dominant regime, or else helping to transform it—contingent on specific empowerment strategies (see Table 1).

Illustrating a conform role, some organic systems have increased reliance on biological inputs to raise productivity for more price-competitive food. Some biological inputs have become commoditized, thus, continuing farmers’ dependence on input suppliers. As a broad ambiguous concept, sustainable intensification agendas have appropriated some agroecological methods in efforts to increase yields while also enhancing environmental sustainability, often within monoculture systems. This illustrates the neo-productivist paradigm prevalent in policy frameworks, whereby agroecological practices can (at most) conform to the dominant agro-food regime.

To play a transformative role, participatory research needs to combine agroecological science, farmers’ knowledge, and citizens’ groups. Collaborative strategies need to go beyond the linear stereotype whereby scientists “transfer” techniques or farmers “apply” research results. Crucial is the opportunity and capacity for collective involvement in shaping research agendas. For a transformative role, farmers intensify their collective knowledge and use of local natural resources, in collaboration with scientists.

A participatory knowledge creation and exchange has already been happening among farmers and with some agroecological scientists. To the extent that farmer–scientist alliances gain research funds based on co-creating and exchanging knowledge, such gains can transform the research system.

Conversely, research can help strengthen relocalization strategies building consumer support for agroecological production methods.

European policy-landscape changes have been opening up more opportunities for agroecological research. This can be designed and appropriated for divergent agendas, as analyzed here. Tensions between conform versus transform roles arise in research agendas, especially in three areas: farm-level agroecosystems development; participatory plant breeding; and short food-supply chains remunerating agroecological methods.

Collective-action networks can better develop transformative strategies by recognizing such tensions, corresponding to different forms of empowerment and potential futures. Progress depends on transforming wider institutions on which farm-level practices depend.

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