

POSITION PAPER

Agroecology as a means to transform the food system

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1 Why does the food system need transformation?

The current global food system(s) has many negative environmental, nutritional, economic and socio-political impacts. Environmental impacts include high levels of greenhouse gas emissions (IPCC, 2019), water pollution (Evans et al., 2019), land degradation, biodiversity loss and the decline of other ecosystem services (IPBES, 2019), which have led some scientists to suggest the food system is exceeding 'planetary boundaries' (Campbell et al., 2017). While there is more than enough food produced to feed global populations, over 800 million people experience chronic food insecurity and suffer from malnutrition, with more than 10⁹ people suffering health problems associated with overconsumption of food high in fat, salt and sugar (FAO et al., 2019; Willet et al., 2019). Although the majority of the world's food, and in particular nutritious food types, is still produced by small to mid-sized farmers, fishers and livestock keepers (Herrero et al., 2017), it is increasingly difficult for small and medium-sized farming households and food enterprises to survive, making rural livelihoods often fragile and precarious (HLPE, 2013). Concerns have also been raised about the democratic governance and equity of the food system, with the profits and control accruing increasingly to a very concentrated few large companies, on both the input and supply side (IPES-Food, 2016). The covid-19 pandemic underscored weaknesses in

the food system, increasing risks of supply shortages in some supply chains, revealing the vulnerability of many households to food insecurity, the lack of adequate social safety nets, and the linkages between environmental and human health (Altieri and Nicholls, 2020; Blay Palmer et al., 2020). Numerous scientific studies and reviews have called for the transformation of the food system, to ensure that it is kept within environmental limits while addressing these health, food security, social and political concerns (IPES-Food, 2016; Mbow et al., 2019; Springmann et al., 2018; Willet et al., 2019). Agroecology is one potential overarching approach to transform the food system and to address these interacting and overlapping negative impacts, which includes a focus on power inequities (Blay-Palmer et al., 2020; HLPE, 2019; Mbow et al., 2019).

2 How can agroecology help to transform the food system?

Agroecology is a holistic approach to food production, which uses ecological methods while also addressing the health, social and economic dimensions of the food system (HLPE, 2019). Considered a science, practice and social movement, agroecology operates at the field, farm and food system levels (Wezel et al., 2014). Agroecological practices include increasing biodiversity, recycling organic material, minimizing toxic inputs such as pesticides, and having integrated

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crop-livestock systems. Some scholars differentiate between scientific agroecology which focuses on the ecological processes to harness in agricultural production, and political agroecology that considers the social, political and economic dimensions of food production in system transformation (Méndez et al., 2013). Political agroecology proponents argue that to transform the food system requires efforts that address its inequities and tackle power dynamics at multiple scales (Anderson et al., 2020; González de Molina et al., 2019). Principles of agroecology which do so include addressing social (in)justice and equity, (re)building direct linkages between producers and consumers, co-production of scientific knowledge, and fostering greater democratic governance of the food system (Dumont et al., 2016; FAO, 2018; HLPE, 2019). Agroecological practices beyond the farm gate comprise initiatives that 1) address gender inequity; 2) use horizontal educational methods such as farmer-to-farmer networks and participatory guarantee systems that link producers to consumers to ensure transparency and equity in local markets (Dumont et al., 2016; Loconto et al., 2018; HLPE, 2019). Transforming governance processes, so that power inequities between consumers, producers, governments and multinational companies are addressed at multiple scales, is considered a key dimension of agroecological transitions (Anderson et al., 2020). Political agroecological initiatives aim at establishing mechanisms for small-scale farmers to have input into policies that influence their production systems, such as increased tenure for land rights or access, greater control over seeds, subsidies for diversified production and addressing consumer needs, e.g. by subsidizing locally produced nutritious foods (Anderson et al., 2020).

3 Environmental, health, social, economic and political dimensions of food system: Evidence for agroecology's impact

3.1 Environmental impacts

There is increasing evidence of the positive environmental impacts from the use of agroecology. A systematic review found robust evidence that agroecological practices are effective for climate change adaptation, using key indicators such as soil organic carbon, soil microbial activity, crop yield stability, biodiversity conservation, and natural plant protection (Muller et al., under review). Landscape complexity is another important feature, through the use of hedgerows, intercropping, and integration of animals, forests, wetlands and other landscapes, which allows for multipurpose benefits, including biodiversity conservation and climate change adaptation (Kremen and Merenlender, 2018; Kremen and Miles, 2012). The integration of livestock, trees and cropping systems allows for food production, biodiversity conservation and carbon sequestration, for example with free-range poultry and olive orchards (Paolotti et al., 2016). Generally, agroforestry systems could be considered as part of an agroecological approach, and provide sources of food, livelihoods and ecosystem services including carbon sequestration (Lasco et al., 2014; Mbow et al., 2014).

3.2 Food security, nutrition and health

Increasing biodiversity in farming systems, a key practice in agroecology, has been significantly and positively associated with many changes. These include improved dietary diversity, food security and nutrition for small-scale food producers and rural communities, although with context-specific impacts (Bellon et al., 2016; Bezner Kerr et al., 2019a; Bharucha et al., 2020; Jones, 2017; Luna-González and Sørensen, 2018; Pellegrini and Tasciotti, 2014; Powell et al., 2015). A recent study of Zero Budget Natural Farming (ZBNF) in India, a grassroots movement promoting agroecological practices, found that while this approach is likely to reduce soil degradation and improve yields for low-input farmers, those who rely on high input levels are likely to experience yield penalties due to nitrogen limitations (Smith et al., 2020). Other studies looking at the social and ecological impacts of the ZBNF approach in India have found significant increases in income, food security and farmer autonomy (Bharucha et al., 2020; Khadse et al., 2018). Health impacts from agroecological approaches, for which there is less evidence to date, are reduced exposure to toxic inputs such as pesticides and improved mental health outcomes. In India, farmers participating in the ZBNF initiative have reported improved health and household income resulting from reduced purchased inputs such as pesticides (Khadse et al., 2018). A case-control longitudinal study of 548 households participating in an agroecology and nutrition project in Tanzania found significant improvements in women's mental health, linked to improved food security (Cetrone et al., 2020). The emphasis of agroecology on the co-creation of knowledge, experimentation and greater linkages between producers and consumers, can also provide more opportunities for meaningful, decent work for small-holder farmers with potential impacts on well-being (Bezner Kerr et al., 2019b; Timmerman and Félix, 2015; Deaconu et al., 2019).

3.3 Food production productivity

Globally, there is concern that agroecology cannot provide adequate food for growing urban populations. One modelling study by Muller et al. (2017) considered the potential to convert to organic production under different climate change scenarios and with other food system changes including addressing food waste and changing food consumption patterns. They found that a complete conversion to organic production will use more land but have environmental benefits associated with reduced pesticide use, nitrogen pollution and greenhouse gas emissions, although there would need to be adjustments in consumption practices and food waste crucial to ensure sustainable food systems. At a regional scale, one study in Europe modelled a transition to agroecological methods over 10 years, and estimated that while food requirements would be met, there would be a decline in food production by 35%, while improving biodiversity, natural resource conservation and reduction of greenhouse gas emissions by 45% (Poux and Aubert, 2018). Other meta-reviews of the global potential for organic and agroecological food production methods have found changes in yield ranging from 27% declines to 61% increases (Barbieri et al.,

2019; D'Annolfo et al., 2017; Reganold and Wachter, 2016; Ponisio et al., 2015). These studies have ranged in terms of what crops, rotations, intercrops, consumption patterns, food waste and other assumptions are built into the models, with most models relying on high income country data sets, and not differentiating between organic and agroecological production. Since organic production includes large-scale, industrial style monocrop production, such models do not fully assess the potential of a diversified, agroecological approach. Given the limited investment in agroecological research (DeLonge et al., 2016; Miles et al., 2017; Pimbert and Moeller, 2018), these global and regional models need further elaboration on the impacts of agroecological production.

3.4 Labour, livelihoods and employment

There is limited research to date on the labour implications of agroecological practices, or on the livelihood- and employment-related implications. While some scholars purport that mechanised farms are beneficial because of the labour-intensity of agroecological practices, it is neither known to what extent this helps, nor what the implications of labour-intensified farming practices will be (HLPE, 2019). There are often tradeoffs between capital costs of mechanisation, associated debt load, reduced autonomy and labour. In-depth interviews in Malawi with over 100 farmers who used agroecological practices found that many small-scale farmers did not consider agroecological practices to be more labour intensive, but instead re-directed their labour to their farms, instead of off-farm labour during times of food shortages. Intercropping could reduce labour due to reduced weeding requirements. Other farmers did find crop diversification and compost production more labour intensive, and reported tradeoffs with child care and leisure (Bezner Kerr et al., 2019b).

Overall impacts that agroecological approaches have on income and livelihoods is also a research gap. A number of studies have reported that agroecology can increase incomes by diversifying the crops and animals that can be sold, reducing purchased inputs and associated debt loads (Padulosi et al., 2015; Bharucha et al., 2020). Our research in Malawi with over 1000 households found a significant increase in both food security and income for those households using agroecological practices (Kanmennang et al., 2017). Some of the increased income arises from reductions in purchased inputs, but we also found evidence of increased social capital arising from farmer networks (Kansanga et al., 2020). In regions where labour is more available than capital, particularly for small-scale farmers, such as south Asia or sub-Saharan Africa, labour-saving practices may not be desirable. The increased use of labour-saving technologies such as herbicides or mechanisation can actually reduce employment opportunities for low income rural workers and reduce the viability of farming for small-scale farms. In contrast, agroecological principles, which emphasize localized economies with shorter value chains, can support increased local food businesses (Loconto et al., 2018). Regional or territorial approaches can be important to support diversified livelihoods and local economies. One global meta-review found that diversified farming systems increased employment in

44 countries (Garibaldi and Pérez-Méndez, 2019). Further research on agroecology's impact on working conditions, employment and livelihoods is needed.

4 Political dimensions of agroecology

A number of studies examine the political dimensions of agroecology at a national or regional scale. The French government implemented a law to transition to agroecology, which included initiatives to support it, bringing together farmers, academics, non-governmental organisations and educational organisations. The government effort comprised over 10 million Euros and supported 9000 farmers, along with other stakeholders, working on agroecological initiatives, and, although, limited to date, raised awareness about alternative approaches to intensified production (Bellon and Ollivier, 2018). In Brazil, social movements and civil society mobilisation supported a widespread effort to address family farming, which included agroecological initiatives within particular public policies, despite agricultural intensification as a dominant paradigm (Petersen and Silveira, 2017). A 'National Policy for Agroecology and Organic Production' was established in 2013. National programmes supported different agroecology networks and initiatives, including community seed banks, agroecological fairs, and support to agroecological farmers to sell to the national school meals programmes (Petersen and Silveira, 2017; Valencia et al., 2019; Wittman and Blesh, 2017). The Zero Budget Natural Farming network in India has mobilised hundreds of thousands of farmers to use organic farming methods, which has reduced their input dependency (Khadse et al., 2018). The state of Andhra Pradesh in India has supported this approach through government extension and funding. Political mobilisation around natural farming methods as a means to reduce farmer indebtedness, a major issue in India, has been one of the features of success in this context (Khadse et al., 2018).

5 What are some examples of the integrated impacts of agroecology?

In smallholder farming communities in Malawi, long term research on those using agroecological methods showed evidence of improved food security, nutrition, sustainable land management and gender relations through innovative educational strategies and agroecological approaches (Bezner Kerr et al., 2019a; Bezner Kerr et al., 2019b; Kangmenang et al., 2017; Kansanga et al., 2020). Participatory, community-based methods were key, including the use of theatre, small group discussions, on-farm experiments and farmer-to-farmer teaching and efforts to address household gender inequities in workload and decision-making (Bezner Kerr et al., 2019c; Nyantakyi-Frimpong et al., 2017). Farmers tested a range of agroecological practices including legume intercrops, compost, agroforestry and crop diversification, which had positive impacts on yield stability, reduced fertiliser inputs and increased soil cover (Snapp et al., 2010; Bezner Kerr et al., 2007; Bezner Kerr et al., 2019a). There was evidence of gender power inequities being addressed, with women

having more of a say in farming, while men reported greater involvement in childcare and household work (Bezner Kerr et al., 2019b). Communities also mobilised to share seeds, knowledge with other villages, helping to build social capital (Bezner Kerr et al., 2018; Kansanga et al., 2020).

At a regional scale, in southeast France, the Drôme Valley has a strong network of cooperatives, organic farmers and organic supply chains, supporting livestock rearing, wine, cereal, fruit and lavender production (INSEE, 2011). A collaboration between the regional government, cooperatives, farmers and local businesses supported knowledge-exchange groups for organic production, a large-scale food hub and vegetable processing factory, alongside public procurement of organic foods for school canteens and day-care centres. Diversified organic production and local consumption has increased significantly alongside local business opportunities in the valley (Wezel and David 2012; Bui, 2015; IPES-Food, 2018).

In Brazil, there is evidence that social mobilisation led to increased land access and public procurement policies such as the 'National School Feeding Programme'. It also supported farmers who have diversified farm products, and provides a premium for certified organic and agroecological production. It also increases agrobiodiversity on-farm, and reduces input intensity, particularly for larger farms (Valencia et al., 2019). Farmers also invested more in soil health with increased application of manure and compost (Blesh and Wittman, 2015). Farmers reported that they shifted from low diversity, high-input farming systems to diverse, low input systems, in part because of the guaranteed, stable source of income from the national school feeding programme, alongside the support from non-governmental organisations and farmer organisations (Guerra et al., 2017; Valencia et al., 2019). The 'Bolsa Familia' programme, part of the 'Zero Hunger' strategy, provided cash stipends for low income households that also helped boost local economies, and allowed many farm labourers to become independent farmers. Small scale producers were linked with schools for the supply of fresh nutritious meals. School lunch programmes reduced in cost while improving in food quality: the offering of fruits and vegetables in schools increased from 28% and 57% in 2004 to 62% and 80% in 2006, respectively (Wittman and Blesh, 2017).

6 Conclusion

Many scientific and policy reports have noted the need to transform food systems to ensure the long-term sustainability of our planet and communities. Most policy efforts, however, tend to focus on technical, agronomic field-level initiatives or changes in individual consumer behaviours (e.g. Willett et al., 2019; Springmann et al., 2018). Such efforts are likely to replicate the same forces that benefit from the current food system. Agroecology is a transformative approach that brings together environmental, social and political aims. One important aspect of agroecology is a focus on power inequities through addressing social, economic and political dimensions of food production (HLPE, 2019). While there is considerable evidence of its potential, there are also

major barriers to using agroecological approaches, since this approach tackles power inequities at multiple scales, such as the concentrated power of input suppliers and retailers in the food system, and gender inequities, through increasing both producer and consumer agency (HLPE, 2019). Effective transformation will require concerted attention to tackling such power dynamics, alongside the complex, context specific questions of effective ecological methods of food production (Anderson et al., 2020). Although further investments in the analysis of impacts of agroecological approaches on labour, employment, global and regional food production and health outcomes are needed, there is considerable evidence to date which supports agroecology's potential to meet social, economic, health and environmental priorities in society.

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