Part II – Evidence

Agroecology as a Key Pillar of A National Food Policy

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The evidence of the multiple benefits and potential of agroecology is extensive and concrete.

There is growing evidence that, despite being significantly marginalized in policy-making and in a regulatory environments that favours the industrialisation of agriculture, that agroecology can produce comparable or superior yields at lower cost with greater profitability, sustain more diverse and nutritious diets than other production systems and lead to the regeneration of the natural basis of agriculture (IPES-Food, 2018, 2016). Agroecological approaches are poised to play an important role in securing sustainable diets as part of a transition towards more sustainable food systems that enhance FSN (Pimbert and Lemke, 2018).

Agroecological practices have been found to be an important contributor to food and nutrition security and have been mapped out to contribute to 10 of the 17 SDGs (UN, 2015) through integrated practices that cut across many areas (FAO, 2018c) and help address poverty and hunger, education, gender equality, decent work and economic growth, reduced inequalities, responsible consumption and production, climate action, life on land, and peace and justice. Along with the SDGs, agroecology can also contribute to managing the synergies and trade-offs between adaptation, mitigation and agricultural productivity (St-Louis et al., 2018). Agroecology is also poised to help realize the aims of the Paris Climate Agreement, and the Convention on Biodiversity.

Livelihoods and Yield

When appropriately supported and in an enabling economic conditions - agroecology can outperform conventional systems of production in many contexts (Ponisio et al., 2015; Pretty et al., 2003; Reganold and Wachter, 2016). Agroecology has also been found to improve the sustainability and efficacy of rural landholdings, especially when the multifunctional benefits

such as employment, ecosystem functions and the quality and diversity of food are taken into consideration (IAASTD, 2009). For example, a recent empirical study showed that agroecological farms generate, "levels and stability in incomes and employment that are all, under current circumstances, superior to those generated by conventional and industrial farming" (van der Ploeg et al., 2019). In a recent meta-analysis, d'Annolfo et al. (D'Annolfo et al., 2017) showed that, following the adoption of agroecological practices, yields increased in 61 percent of the cases analysed and decreased 20 percent, while farm profitability increased in 66 percent of cases. Beyond the potential to increase the productivity of small farms, when agroecology is evaluated for its multifunctional ecological and social benefits, it often outperforms high-input systems.

Environmental: Climate Change and Biodiversity

Ecologically, these systems are low-impact; they are regenerative of biodiversity, soils and the environment, in contrast to highly degrading forms of external input, intensive agriculture. Through the minimal use of fossil fuels and high-energy (chemical) external inputs, as well as sequestering carbon, agroecology can also contribute to climate change mitigation. The complex adaptive systems in agroecology are also highly resilient to flooding, hurricanes, pests and drought. Studies have shown that agricultural producers using agroecological practices such as crop diversification, maintaining local genetic diversity, animal integration, soil organic management, water conservation and harvesting are more resistant to ecological disasters than monocropping (Altieri and Nicholls, 2017; Holt-Giménez, 2002).

Agroecology is one of the key levers we can pull to reverse the climate crisis and to help farmers adapt and thus increase resilience to environmental change (FAO, 2018a; HLPE, 2019). While many modern farming practices are a major source of greenhouse gas emissions and are highly energy-intensive, agroecological practices have been shown to reduce on-farm emissions and overall GHG impacts as well as, critically, pull carbon dioxide from the atmosphere by building health soils. In Lin et al.'s review (2011), the authors identify three ways that agroecology can reduce GHG contributions of agriculture and food systems (Lin et al., 2011):

a) A decrease in the materials used and fluxes involved in the release of GHGs based on agricultural crop management choices (Also see: Niggli et al., 2008)
b) A decrease in the fluxes involved in livestock production and pasture management
c) A reduction in the transportation of agricultural inputs, outputs and products through an increased emphasis on local food systems.

Lin et al.'s analysis presents the mitigation advantages of various agroecological approaches for three primary GHGs (table 1).

Table 1 *- Selected agricultural practices and their potentials for climate change mitigation comparing industrial and agroecological techniques. Source: Lin et al. 2011.*

Mitigative effects					
Practice	CO_2	CH_4	N_2O	Agro-ecology	Industrial
Agronomy					
Cover crops/avoiding bare fallows	+		+/−	X	[1]
Eliminate/very limited use of external inputs (synthetic pesticides and fertilizers)	+			X	
Nutrient management					
N-fixing plants	+		+/−	X	[2]
Crop–livestock integration	+		+	X	[3]
Improve nutrient-use efficiency	+		+	X[4]	X
Tillage/residue management					
No-till	+		+/−	X	X
Reduced till organic	+		+/−	X	
Agro-forestry	+		+/−	X	
Livestock grazing intensity	+/−	+/−	+/−	X	[5]
Grazing land nutrient management	+		+/−	X	X
Restoration of degraded lands					
Erosion control	+			X	X[6]
Addition of measures or composts	+		+/−	X	[7]
Improved manure storage and handling		+	+/−	X	X
Manure anaerobic digestion		+	+/−	X	X
More efficient use of manure as a nutrient source	+		+	X	X

+ Indicates reduced emission or increased removal (positive effect on mitigation).
− Indicates increased emission or decreased removal (negative effect on mitigation).
[1]Although there is little systematic research on the frequency of use of cover crops, three sources indicate it to be far more common among organic/agro-ecological farmers than industrial farmers [13, 15, 16]. Ridgley's survey of ~100 California farmers indicated that 70–100% of organic farmers used cover cropping; only 8% of conventional farmers self-reported as using it. Singer *et al.*'s survey of 3500 US Corn Belt farmers found that only ~10% of farmers had recently used cover crops. Although they did not split the data by organic or conventional farming, cover crop use was significantly correlated with two agro-ecological norms: greater crop diversity (although the magnitude difference in number of crops was low; mean of 3.12 versus 2.51) and raising of both crops and livestock (52% versus 38%).
[2]N-fixing plants are most often used as cover crops (see Note 1), but may also be used in relay or intercropping schemes, while cover crops may also be non-leguminous.
[3]Industrial systems are usually definitionally considered to not include integration (see [41]), but the relevant empirical data rarely includes specific characteristics of production systems. Agro-ecological systems encourage, and in some cases require such integration [61].
[4]Agro-ecological systems may have a much greater relative potential to increase use efficiency as compared with other mitigative practices [67].
[5]Grazing intensity is projected to increase in coming years [14], but cultural, practical and sometimes regulatory restrictions limit livestock intensity in many agro-ecological systems in ways not typically reflected in industrial systems (see [61]).
[6]A variety of erosion control strategies is nominally practical in both industrial and agro-ecological systems. Agro-ecological agriculture, however, arguably has a larger range of such practices already in use, available or common to it, such as hedgerows, agroforestry, cover cropping and other strategies involving structural complexity [14, 60, 61]
[7]Additional use of manures or compost is possible in either system, but as with other practices reviewed here, may be more common or practicable in agro-ecological systems.

Agroecology also responds to the urgent need to address biodiversity loss. The central idea of agroecology is that agroecosystems should mimic the biodiversity levels and functioning and heterogeneity of natural ecosystems. Agroecological practices thus seek to emulate the diversity, structure, and function of natural ecosystems (Altieri, 2018; Gliessman, 2014). Such biodiversity-rich agricultural mimics, like their natural models, can be productive, nutrient conserving, carbon fixing, pest resistant and relatively resilient to stresses such as climate change. Because of the portfolio effect of heterogeneous and biodiverse agricultural production, they also mitigate the impact on farmers' incomes of market price volatility. In sum, the agroecological practices of farmers, pastoralists, fishers, forest dwellers and indigenous peoples play a key role in sustaining and improving agricultural biodiversity (genetic diversity to ecosystem diversity) at different scales – from farm plots to whole landscapes and territories (FAO, 2018b:Pimbert, 2019 #731; 2019). Support for agroecological practices that promote high levels of agricultural biodiversity on farms and the wider landscape can significantly contribute to mitigation and adaptation to climate change as well as conserve and enhance ecosystem functions (e.g. pollination), goods and services (IBPES, 2019).

Health

Agroecology has also been shown to have strong links with dietary diversity and nutrition security (Pimbert and Lemke, 2018) and numerous studies have found positive relationships between diversified farming systems (a key principle of agroecology), household dietary diversity and nutrition (Dawson et al., 2013; DeClerck, 2013; Jones, 2017; Jones et al., 2014; Oyarzun et al., 2013; Talukder et al., 2016).

There has been very little investment in measuring the multiple benefits and/or drawbacks of agroecology whereas instead funding for agriculture research has emphasised high tech/input agriculture. Despite this handicap, the existing body of literature indicates that agroecology has significant potential to address many of the problems faced by agriculture and food systems in the UK.

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