# Agroecology, Climate Change Induced Polycrisis and the Transformation of Food Systems

https://www.e-ir.info/2022/04/20/agroecology-climate-change-induced-polycrisis-and-the-transformation-of-food-systems/

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The harsh realities of climate change are becoming more visible and dangerous throughout the world according to the latest assessment of the IIPC. Experts project that in the coming decades climate change will increase in all regions and that a 1.5°C of global warming between 2030 and 2052 will be linked to increasing heat waves, longer warm seasons and shorter cold seasons. Today's greenhouse-gas concentration is >500 ppm CO2-e, which according to the IPCC gives Earth a mere 66% chance of not exceeding a 2°C warming, which would surpass critical tolerance thresholds for human, agriculture and ecosystems health. Most quantitative assessments of the impacts of climate change on food systems show that climate change will adversely affect food security (increasing the number of additional people at risk of hunger by 2080 up to 170 million**)** by altering food availability (i.e., production and trade), access to food and the stability of food supplies. Compiled extensive published results from four analytical methods indicate that each degree-Celsius increase in global mean temperature would, on average, reduce global yields of wheat by 6.0%, rice by 3.2%, maize by 7.4%, and soybean by 3.1%, four crops that provide 2/3 of the global calories.

But climate change constitutes only a manifestation of a cascade of catastrophes that are threatening the industrial agriculture model which covers 80% of the global arable land with vulnerable genetically homogenous and ecologically narrow monocultures, dependent on large quantities of agrochemical inputs (more than 5.2 billion pounds of pesticides and 186.67 million tons of chemical fertilizers are applied annually worldwide). Food systems are responsible for about 60% of global terrestrial biodiversity loss and for about 31% of the global GHG emissions (the global food system is a leading driver of climate change). Moreover, although industrial production systems cover >70% of the arable land, using massive amounts of water and fossil fuels, they produce only 30% of the food consumed worldwide.

The agrochemical dependency of food systems has now been exposed by the Russia-Ukraine armed conflict which sent fertilizer prices skyrocketing, coupled with surging food prices fueled by war-curtailed wheat exports, raising the prospect of world food shortages and political instability particularly in grain importing countries. All this is on top of efforts by countries to recover from the COVID-19 pandemic which disrupted food systems worldwide, affecting food security and the nutrition of rural and urban populations by affecting the availability of seasonal workforce, limiting access to input supply, forcing the closure of markets, disrupting transport networks and increasing the risk of supply-side shortages.

These scenarios prompt a key survival question for humanity: how ready is our industrial food system to confront the polycrisis (energy shortages, water scarcity, environmental degradation, biodiversity loss, climate change, economic inequality, food insecurity, military conflicts and others) affecting our planet? One thing is certain, these problems cannot be addressed in isolation, as they are interconnected and interdependent. When one of the problems is aggravated, the effects spread throughout the system, enhancing the other problems. The underlying causes of pandemics are the same global economic forces and environmental changes that drive biodiversity loss and climate change. As we have witnessed, the pandemic-induced health crisis has quickly triggered an economic crisis, which is unfolding in the context of a climate crisis, in turn exacerbating the pandemic and the economic crisis.

The systemic nature of the polycrisis revealed the hidden tragedy of animal factory farming and endless monocultures which lead to dramatic biodiversity loss, soil and water contamination, malnutrition, obesity, zoonotic diseases, appalling working conditions for migrant workers and undermined livelihoods of small farmers. It also revealed how closely human, plant, soil, animal and ecological health are linked, and is leading to the understanding that the way industrial farming is being practiced poses major risks to human wellbeing and ecosystem integrity. Modern agriculture is failing the resiliency test and is inadequate to feed the world in the face of climate impacts. The continuation of the current agricultural paradigm is not an option and transformative change is fundamental in order to match (and hopefully reverse) the relentless progression of environmental threats tied to the continuous expansion of industrial agriculture.

But the conventional narrative still persuades the international agenda, arguing that by 2050, the human population will reach 9.8 billion which supposedly requires a 100 to 110% increase in global crop production. To achieve this, agribusiness and allies argue that sustainable intensification is needed to avoid the expansion of agricultural land and pressure on natural ecosystems as much as possible. This Malthusian perspective has dominated agricultural development since the Green Revolution and despite all efforts to increase production to end hunger, malnutrition in all its forms and insufficient access to nutritious food, remains the reality for almost a billion people. Hunger today is not a consequence of yields being too low or of global supplies being unable to meet demand; rather it is due to poverty, deficient food distribution, food waste, lack of access to land and other aspects of the food system. A productivity view of hunger fails to alter the tightly concentrated distribution of economic power that determines why masses of poor and vulnerable people lack access to food, or why small farmers who produce between 50-70% of the global food on only 30% of the arable land still lack access to seeds, breeding stock, water and land to produce even more.

Despite this recognition, the majority of conventional recommendations are limited to adjusting or reforming the current food and agricultural system with an arsenal of new technologies (gene editing and new biotechnologies, digital farming, precision agriculture), and even new approaches guised as ecologically-based such as climate smart agriculture, regenerative agriculture and carbon farming, all representing 'market-based solutions, risky techno-fixes and "net zero" proposals by corporate-controlled governments, transnationals, philanthropists, mainstream media and most NGOs.' Such approaches are part of the co-optation, colonization and institutionalizion of agroecology stripping of its political content. None of them addresses the primary political and economic drivers of the current food system crisis, namely the monoculture structure of cropping systems and the corporate power that nurture it. Encouraging farmers and land-forest owners to adopt practices that sequester carbon dioxide in the soil and in biomass to mitigate climate change raises various concerns from displacement of small farmers to undermining food sovereignty.

By contrast, The Via Campesina calls to urgently get away from the logic of offsetting, to reduce actual emissions, and instead promote agrarian systems based on of small-scale diversified farming systems which cool the planet. Other proposals such as food waste reduction with the adoption of a sustainable diet to reduce the biodiversity toll of the current food system are politically naïve as they impede recognition of the magnitude of the challenge, ignoring the inequality of poor and vulnerable people who cannot afford such actions and end up paying the costs of biodiversity loss and climate collapse to which they did not contribute. The agroecological movement is organizing against the co-optation and institutionalizion of agroecology which stripped of its political content. In this paper, we analyze this quandary in terms of political ecology: will agroecology end up as merely offering a few more tools for the toolbox of industrial agriculture, to fine tune an agribusiness system that is being restructured in the midst of a civilizational crisis or, alternatively, will it be strengthened as a politically mobilizing option for building alternatives to development?

Transformative change in food systems can only be achieved by promoting policies that ensure that small farmers have secure access to land, water and seeds and animal breeding stock to produce food based on agroecological practices, distributing diverse foods locally via solidarious markets, and making them accessible to all segments of urban and rural societies, in particular for the hungry and food insecure.

Only agroecology holds a transformative potential to cope with future challenges posed by ecological ruptures like

climate change and COVID-19, by exhibiting high levels of diversity and resilience, both emergent properties known to reduce risk from climate change or other threats, while delivering reasonable yields and providing key ecosystem services to society. Agroecology shows a different way forward by providing the principles on how to design and manage agricultural systems best able to withstand future crises – whether pest outbreaks, pandemics, climate disruptions, or financial meltdowns, by territorializing food production and consumption. Thousands of agroecological initiatives around the world that revitalize peasant and traditional farming systems which have stood the test of time improve food sovereignty while contributing to biodiversity conservation at the farm and landscape level. Plant species and genetic diversity enhancement boosts the overall resilience of food systems against new climate and environmental changes.

Observations of agricultural performance after extreme climatic events (hurricanes and droughts) in the last two decades have revealed that resiliency to climate disasters is closely linked to farms with increased levels of biodiversity. Agroecological designs promote farms inserted in a complex landscape matrix, featuring adapted local seeds deployed in diversified cropping systems managed with soils rich in organic matter and water conservation-harvesting techniques. The identification of systems that have withstood climatic events recently or in the past and understanding the agroecological features of such systems that allowed them to resist and/or recover from extreme events is of increased urgency. This is because the derived resiliency principles and practices that underlie successful farms can be disseminated to thousands of farmers via Campesino a Campesino and lighthouse networks to scale up agroecological practices that enhance the resiliency of agroecosystems. Such initiatives have been successful in reconstructing agricultural systems in hurricane affected areas of Cuba and Puerto Rico.

But 'ecologizing' the required agricultural revolution will not be sufficient to reduce hunger and poverty, conserve biodiversity and enhance climate resiliency. Transformative change in agriculture involves dismantling the industrial agrifood complex and the corporate control over production and consumption. It requires restoring local food systems with greater reliance on alternative food networks and solidarious alliances between producers and consumers. Markets provisioned by biodiverse farms, oriented to local and regional markets are more flexible to respond to changes and perturbations. Territorial markets tend to be less vulnerable to price changes and collapse of centralized supply chains by reducing the dependence of producers and consumers from large corporations that control global supply chains prone to political, economic and climate disruptions.

The polycrsis reminds us of the urgent need that food production be in the hands of small producers, peasants and urban farmers that produce under the agroecological principles of diversity, efficiency and synergy. It is the only way to ensure the supply of fresh food, at affordable prices and in local markets, even in the midst of climate, pandemic or other disruptions. But the weight of changing the food system cannot rest only on famers' shoulders. It is crucial to raise awareness of urban dwellers of the significance and maintenance of biodiverse, adaptable farming systems associated with family agriculture, and the realization that eating is both an ecological and political act. When consumers support local farmers, instead of the corporate food chain which is more vulnerable than small farmer food webs to natural and human caused interruptions, they create socio- ecological sustainability and resilience.

The latest IPPC report recognizes the benefits of agroecology, which is positioning itself as a key agricultural path that can provide rural families with significant socioeconomic and environmental benefits, while feeding the urban masses, equitably and sustainably. Ultimately, transformative change in agriculture must be accompanied by a shift from a market economy to a solidarity economy, from fossil fuel dependence to renewable energy, from big corporations controlling the food system to cooperatives. Unfortunately, implementation of solutions is delayed by governments that lack the political will for effective action towards a system-wide technological, economic, and social reorganization. Despite this situation and without support, thousands of farmers across the world stubbornly continue dotting landscapes with genetically diverse intercropping, agroforestry and silvopastoral systems and other diversified farming methods that enhance biodiversity, soil health, and resiliency and adaptive capacity to climatic extremes. These heroic efforts displayed mostly by peasants and indigenous people represent spaces of hope against the seemingly totalizing weight of ecological breakdown and social injustice that plague our planet in polycrisis.

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## About the author:

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