

Agroecology: **back to the shovel and the plow?**

EXECUTIVE SUMMARY



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For over six decades, agriculture has been the subject of a recurring promise: that of liberating humanity from hunger and hardship through technological modernization. From mineral fertilizers and synthetic pesticides to biotechnologies and now digital technologies, this narrative of salvation through technical innovation has been restlessly renewed.

The saga of agricultural modernization

Today, the new tools of “Agriculture 4.0” (sensors, software, robots, artificial intelligence...) are presented as a pivotal breakthrough, finally capable of reconciling productivity and sustainability. However, behind these new promises, the same risks persist: the rapid industrialization and homogenization of rural areas, the increase of technical dependency, and the concealment of alternative solutions.

Contrary to what the rhetoric of linear progress suggests, **the path of agricultural modernization followed so far is not a spontaneous or inevitable process.** On the contrary, it is the result of proactive political choices. In post-war Europe, as in the United States, agriculture was tasked with fulfilling a double function: providing food for the population and supporting industrial growth. Public authorities have thus pursued the increase of agricultural productivity by encouraging mechanization, the extensive use of external inputs, and land consolidation and concentration.

On a global scale, the spread of a similar model (the «Green Revolution») was driven by a North American geopolitical strategy aimed at ensuring food security while containing Soviet influence. The broad consensus around this model contributed to its establishment as an indisputable horizon and to shaping an «agro-industrial complex» that links public authorities, prominent agri-food companies and majoritarian agricultural unions. The neoliberal turning point of the 1980s gradually shifted the centre of gravity of this complex from a regulatory state to transnational oligopolist groups, which are now joined by digital giants.

The blind spots of the industrial agrotechnical model

Like any technology, **agricultural technology is never neutral: it embodies worldviews and power relations.** While it can contribute to improving living conditions, it can also exacerbate structural systems of oppression. Historical examples demonstrate that the advantages of technical innovations tend to disproportionately benefit a minority of the population, while their social and environmental consequences are widely spread. In this case, the «externalities» associated with the adoption of the industrial agrotechnical package are vast: soil and water degradation, collapse of biodiversity, greenhouse gas emissions, malnutrition despite caloric abundance, as well as dynamics of dependence (energy, logistics, financial, cognitive...) on an oligopoly of actors that concentrates profits.

Despite its frequent portrayal as the most performant model, this approach’s success indicators are generally limited to productivity per hectare or per hour of work. When considering energy balance however, it proves to be significantly inefficient:

the dominant food system consumes substantially more calories in the forms of coal, oil, and gas than it returns in the form of food. Once the main net source of energy (and fiber), **agriculture now functions as an energy sink sustained by the constant injection of fossil energy.** The progressive scarcity of these resources, which also impacts the capacity to extract and process the minerals essential for the tools and infrastructures of this technical system, makes it inherently vulnerable to any geopolitical and climate shock. Agriculture 4.0, based on an equally energy-intensive hardware chain (antennas, cables, servers, batteries...), risks aggravating this trend, while paving the way for a new wave of dependencies on digital giants. Contemporary agrotechnique therefore operates within an exceptional energy regime that undermines the conditions of its own reproduction and is neither sustainable nor generalizable on a global scale.

Re-establishing the foundation of agricultural technique

Faced with these impasses, agroecology has been recognized by the High Level Panel of Experts (HLPE) on Food Security and Nutrition of the United Nations Global Food Security Committee as the most coherent and mature framework for a transition to equitable and sustainable food systems, capable of feeding the planet. Based on 13 principles that guide holistic transformations articulating social justice, ecology and democracy, **agroecology reintegrates technology into collective purposes broader than mere productivity.** Its innovations are based on the co-creation between sciences, peasant knowledge and local experiences. They develop integrated systems adapted to their specific contexts, strengthening biological self-regulation mechanisms and delivering tangible results in terms of soil health,

water and climate resilience, as well as the diversification of diets and agricultural incomes. The examples of successes are numerous and widespread globally, although often overshadowed by more spectacular technologies.

Agroecology does not call for a block rejection of the modern agrotechnical package, but rather for a reorientation, adaptation, or overcoming of these technologies in the light of plural criteria. Modern genetics, for instance, can play a key role in supporting biodiversity conservation and participatory selection, but becomes problematic when it fuels the patent race. Mineral fertilizers and synthetic pesticides should gradually give way to organic fertilization, long rotations and biological regulation, and be reserved only for exceptional cases. As for heavy mechanization, mainly optimized for monocultures, it should evolve towards greater energy sobriety and adaptation to the diversity of agroecosystems. Similarly, digital technologies designed to be as open and controllable as possible by their users can contribute to an agroecological approach. The challenge is to lighten the work without reinforcing or generating new dependencies, while following transition trajectories tailored to their context: the paths of agroecology will not be identical in the global North and South, because they respond to different stories, resources, and needs.

Ultimately, **the concrete forms of agroecological techniques will only emerge and evolve as a result of collective processes of debate, construction, and governance** — mainly at the local level. Another major challenge is therefore to establish a democratic power over technical orientations, demystifying the illusion of ready-made quick fixes on which the strength of the narrative of modernization by the agro-industrial model rests. The lines of action to contribute overcoming this impasse are multiple:

- [**Strengthen participatory action research approaches, articulating scientific, peasant, and citizen knowledge;**
- [**Reactivate open debate spaces and independent technology assessment institutions, from the local to the global level;**
- [**Treat technology as a Common, governed by collective bodies ensuring its sustainable and equitable use;**
- [**Reaffirm public authority in setting the framework for innovation, and redirecting funds and education towards holistic approaches.**

Agroecology: a model that reconnects technology to life

Is agroecology, therefore, a return to the use of shovels and plows? The answer to this question appears nuanced.

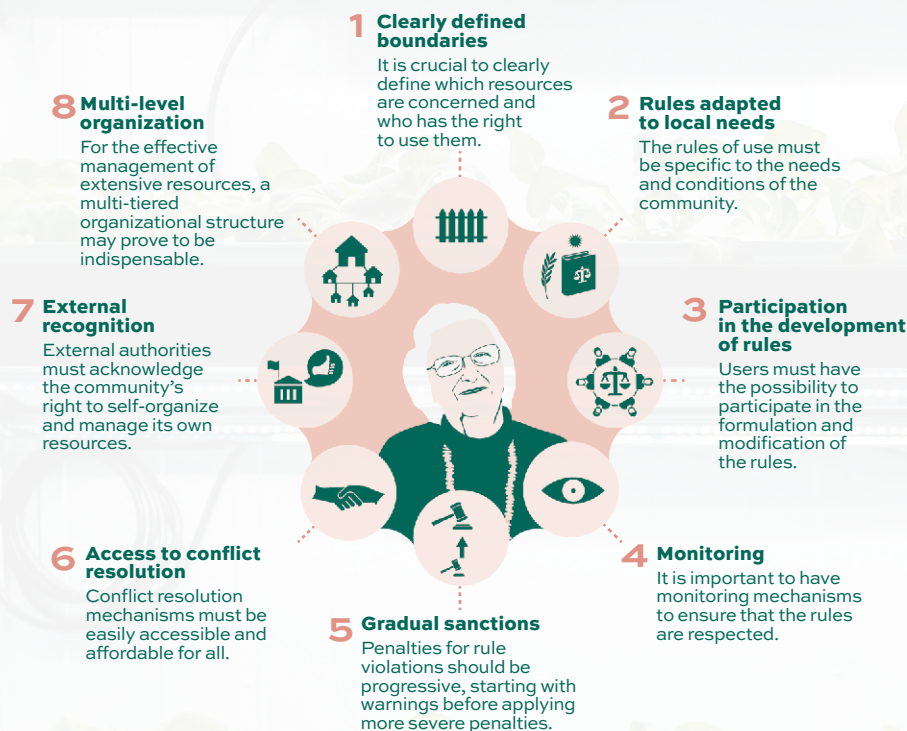
No, because agroecology is not a dogmatic rejection of modernity, but a contextual innovation project that places technology within a broader framework: autonomy of communities, social justice, and regeneration of ecosystems. The real divide lies not between an archaic “before” and a modern “after,” but between

two ontologies of technology: one, Promethean and extractivist, which simplifies the living to better exploit it; the other, relational and eco-centered, which endeavors to forge alliances with natural processes. Agroecology is resolutely aligned with this second perspective.

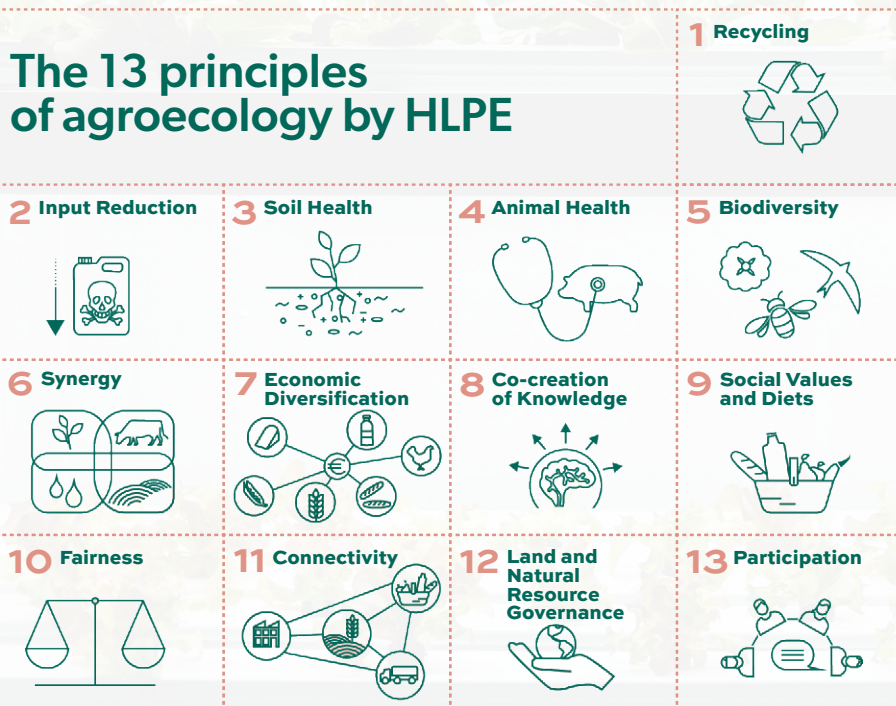
Yes, to the extent that it rehabilitates certain ancient techniques proven for centuries in contexts of severe energy constraints, adapting them to contemporary knowledge to offer robust solutions to current challenges. To rediscover these techniques is not to give up modernity, but to choose wisely, aware of the ecological and social limits of the present model. Agroecology incorporates modern techniques if they enhance autonomy and equity, and avoids them if they compromise them. The key is to sort, adapt, divert, and place each innovation in a clear political framework. The true agroecological modernity resides in this discernment and this contextualization.

Agroecology proposes another path: **not a nostalgic return to the past, but a reinvention of techniques based on sobriety, robustness, conviviality, and care**. The right question is ultimately not whether to go back to the shovel or the plow. It is to ascertain: who decides the tools? For what purposes? In what context? With what visible and invisible (or invisibilized) effects? To these questions, agroecology provides a clear answer: politicize technology.

Elinor Ostrom's 8 principles for managing Commons



The 13 principles of agroecology by HLPE



The Phosphore Collection is a collaboration between the NGOs Autre Terre, Humundi and Iles de Paix.

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The Phosphore collection is a series of studies launched by the SIA collective (Humundi, Iles de Paix, Autre Terre) on the challenges of food systems. It is characterised by the analysis of contested issues that drive the decision-making arenas of food systems. It seeks to understand the reading grids that underlie political discourses, the competing arguments and their scientific validity. Each issue is intended to provide an overview of a debate, and aims to equip readers in the controversy.

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