



## Transforming food systems with agroecology

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## EDITORIAL

# Transforming food systems with agroecology

Agroecology is a way of redesigning food systems, from the farm to the table, with a goal of achieving ecological, economic, and social sustainability. Through transdisciplinary, participatory, and change-oriented research and action, agroecology links together science, practice, and movements focused on social change. But what are the steps that must be taken to transform food systems toward the ultimate goal of sustainability, and away from the mounting evidence of the negative impacts on the environment and society caused by modern industrial agriculture?

In the latest edition of my agroecology textbook (Gliessman 2015b), I propose a framework for classifying “levels” of food system change. The first three levels describe the steps farmers can actually take on their farms for converting from industrial or conventional agroecosystems. Two additional levels go beyond the farm to the broader food system and the societies in which they are embedded. All five levels taken together can serve as a roadmap that outlines in an almost stepwise manner a process for transforming the entire global food system:

*Level 1: Increase the efficiency of industrial and conventional practices in order to reduce the use and consumption of costly, scarce, or environmentally damaging inputs.* The primary goal of change at this level is to use industrial inputs more efficiently so that fewer inputs will be needed and the negative impacts of their use will also be reduced. Most conventional agricultural research has taken place at this level, through which considerable modern agricultural technologies, inputs, and practices have been developed. This research has helped farmers maintain or increase production through such practices as improved seeds, optimum planting density, more efficient pesticide and fertilizer application, and more precise use of water. So-called “precision agriculture” is a recent focus of research at Level 1. Although this kind of research has reduced some of the negative impacts of industrial agriculture, they do not help break its dependence on external human inputs and monoculture practices.

*Level 2: Substitute alternative practices for industrial/conventional inputs and practices.* The goal of this level of transition is to replace external input-intensive and environmentally degrading products and practices with those that are more renewable, based on natural products, and more environmentally sound. Organic farming and biodynamic agriculture are examples of this approach. They employ alternative practices that include the use of nitrogen-fixing covercrops and rotations to replace synthetic nitrogen fertilizers, the use of natural controls of pests and diseases, and the use of organic composts for fertility and soil organic matter

management. However, at this level, the basic agroecosystem is not usually altered from its more simplified form, hence many of the same problems that occur in industrial systems also occur in those with input substitution.

*Level 3. Redesign the agroecosystem so that it functions on the basis of a new set of ecological processes.* At this level, fundamental changes in overall system design eliminate the root causes of many of the problems that continue to persist at Levels 1 and 2. The focus is on prevention of problems before they occur, rather than trying to control them after they happen. Research on whole-system conversions has provided an understanding of key yield-limiting factors. Agroecosystem structure and function is better understood, and appropriate changes in design can be implemented. Problems are recognized, adjustments made in internal site- and time-specific design and management approaches, instead of solely by the applications of external inputs. A good example is the reintroduction of diversity in farm structure and management through such actions as ecologically-based rotations, multiple cropping, agroforestry, and the integration of animals with crops.

*Level 4. Re-establish a more direct connection between those who grow our food and those who consume it.* Food system transformation occurs within a cultural and economic context, and this transformation must promote the transition to more sustainable practices. At a local level, this means those who eat must value food that is locally grown and processed, and support with their food dollars the farmers who are attempting to move through Levels 1–3. This support becomes a kind of “food citizenship” and can be seen as a force for food system change. Communities of growers and eaters can form alternative food networks around the world where a new culture and economy of food system sustainability is being built. Food once again must be grounded in direct relationships. An important example is the current food “re-localization” movement, with its growing networks of farmers’ markets, community supported agriculture schemes, consumer cooperatives, and other more direct marketing arrangements that shorten the food chain.

*Level 5. On the foundation created by the sustainable farm-scale agroecosystems achieved at Level 3, and the new relationships of sustainability of Level 4, build a new global food system, based on equity, participation, democracy, and justice, that is not only sustainable but helps restore and protects earth’s life support systems upon which we all depend.* By thinking beyond Levels 1–4, Level 5 involves change that is global in scope and reaches beyond the food system to the nature of human culture, civilization, progress, and development. The depth of change is more than mere conversion or transition, and enters into the realm of full reform or transformation. With Level 5 thinking and action, agroecology provides ways to build upon farm-scale and farmer-driven change processes to a full re-thinking of how we all relate to each other and to the earth that supports us. Basic beliefs, values, and ethical systems change. The expanding awareness that is part of this process then extends to other facets of

environmental and social relationships beyond food, bringing about a paradigm shift focused on how the agriculture and food systems of the future can help reduce our ecological footprint, recognize that there are limits to growth, and what it really means to live sustainably. The important role that food systems can and must play in mitigating and adapting to climate change as a global issue is one example of the value of Level 5 thinking. The growing food justice movement, where everyone in the food system enjoys the benefits of equity, justice, security, and sustainability, is another.

What will our food system look like when Level 5 thinking and action guides the changes that need to take place? What are the incentives needed to stimulate these changes? Can this thinking bring about essential changes in policy, support systems, funding, and choice? Is the change process actually a stepwise, longitudinal one, starting at Level 1 and ending with Level 5, or should Level 5 thinking determine where the process begins depending on where the farmer or the food system is at the moment? I try to address these questions in my textbook. An important examination of these questions is also addressed in a publication by DeLonge, Miles, and Carlisle (2016) where they report on the use of the 5 Levels System to evaluate to what extent agroecology was supported by the research funding from the USDA's 2014 Research, Extension, and Economics (REE) budget. They found that only roughly 10% of the total REE budget went to projects that contained any of the 5 levels of agroecology. Of these, the bulk of the research support went to projects with elements of Levels 1–3. Very few had any Level 4 activity, and none were considered to support research at Level 5. It seems obvious that the broader goals of sustainability, guided by the change process described above, can serve as an important guide for increased funding support and policies that put agroecology front and center for redesigning food systems.

Some of my earlier editorials call for this broader scope and focus of agroecology (e.g., see Gliessman 2015a), where science, practice, and social change approaches must all be integrated. The 5 levels of practice and action for change provide a very useful framework for guiding this transformational process.

I look forward to seeing further results of the application of the 5 levels for food systems change appearing in our journal.

Steve Gliessman  
Editor

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