SUSTAINABLE AGROECOSYSTEM MANAGEMENT

Integrating Ecology, Economics, and Society

Edited by

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8 Beyond Systems Thinking in Agroecology

Holons, Intentionality, and Resonant Configurations

William L. Bland and Michael M. Bell

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8.1 INTRODUCTION

Goals of scholarly work in agriculture include developing a richer understanding of this essential human endeavor and analyzing potential for interventions into current practice. Such interventions are motivated by a great diversity of issues, for example, less pollution, greater resource efficiency, more stable production, greater social equity. Conway (1985, 1987) introduced "agroecosystem analysis" as a framework for study of farming endeavors, connecting both the concept of the agroecosystem and its analysis, leading toward "systems thinking." The idea of the system, that is, "… a group of interacting components, operating together for a common purpose, capable of reacting as a whole to external stimuli: it is unaffected by its own outputs and has a specified boundary based on the inclusion of all significant feedbacks" (Spedding 1988, p. 18) and systems thinking are now commonplace in a wide range of endeavors, from business management, to health care, to ecology. Indeed, the essence of ecosystem ecology is systems thinking about biota and the relationships among themselves and with their physicochemical environment.

To do systems thinking is to adopt an ontology, that is, to make decisions about the entities and their interactions that constitute reality (at least for the purposes of the task at hand). Systems theorists have long warned us to remain cognizant of the fact that just because an analyst chooses to view some portion of the world as a system does not mean that it is, and behaves as such. Rosen (1991, p. 42) takes very seriously the step of positing the existence of a system: "The notion of system-hood … segregates things that 'belong together' from those that do not, at least from the subjective perspective of a … specific observer. These specific things that belong together, and whatever else depends on them alone, are segregated into a single bag called *system*; whatever lies *outside*, like the complement of a set, constitutes *environment*. The partition of ambience into system and environment, and even more the imputation of that partition to the ambience itself as an inherent property thereof, is a basic and fateful step for science. For once the distinction is made, attention focuses on *system*." Checkland and Scholes (1999, p. 22) illuminate the key distinction: "Choosing to think about the world as if it were a system can be helpful. But this is a very different stance from arguing that the world is a system, a position which pretends to knowledge no human being can have." So while one of the motivations for systems thinking is to be inclusive, actually setting to work on a problem requires identifying and making separate a portion of all that is around us.

There can be no question that systems thinking has contributed greatly to agricultural science. Such thinking stimulates even the most narrowly focused research group to articulate its work with the broader world. Indeed, competitive grant funding in the United States related to agriculture is strongly influenced by the imperative of taking a more holistic approach in which research, teaching, and outreach must all be present and connected. On the other hand, we cannot help but worry that some analysts too easily forget the warnings that agricultural reality may not actually be a nicely connected-up system that, for want of greater understanding and passion for systems thinking, we are not yet managing optimally.

In the spirit of the perspective that systems thinking is an ontological choice—often powerful, but confused with reality at the analyst's peril—we propose here a complementary perspective that we believe holds benefits for all manner of students of agriculture. We have adapted Koestler's (1967) notion of the holon—something that is simultaneously a whole and part (Bland and Bell 2007). For Koestler (1967, p. 210), "Parts and wholes in an absolute sense do not exist in the domain of life. The concept of the holon is intended to reconcile atomistic and holistic approaches." Holon agroecology seeks a middle ground between the reductionism that serves purely scientific enterprises so well and the holism that system thinking implies.

In holon agroecology the farmer—be this a multinational corporation or a mother and child with a patch of rice in Bangladesh—is central. Indeed, we submit that agriculture might most usefully be defined as something like, "humans planning and acting to cultivate livelihoods from plant and animal increase." In this definition the importance of human actors is acknowledged first and foremost. For all our scholarly attempts to "design" and "manage" agroecosystems, whether in developed or subsistence settings, any notion that we can do either should be approached skeptically. Whether because of the political lobbying of a commodity producers' association or the reluctance of poor farmers to change practices learned from their forebears, individual human intentionality seems often to override notions of a thoughtfully designed and managed agricultural "system." This human intentionality is in the vast majority of cases directed at profiting from plant and animal increase, that is, that seeds, soil, and water can lead to an excess of seeds that can be sold, or that baby animals grow and multiply, providing some for exchange. But the intentionality of the individual farmer is likely more than simply profit from biological increase. Included might be sensed obligations to generations before to keep the family farm productive, or a desire to rear farm animals according to some ethical code. Whatever the complex intentionality motivating a farmer, the resulting goals are often realized precisely by pursuing courses of action contrary to what others expect and would wish for. We propose that such complex intentionalities make unlikely the idea that the human agricultural endeavor is, or can become, a well-managed system. Holon agroecology offers ways of simultaneously recognizing farmer intentionality and notions of agriculture as a system.

The holon as simultaneously a whole in some senses and a part of things larger makes its definition an unending challenge. What things are usefully thought of as a holon, and how are its boundaries envisioned? If the holon does indeed "reconcile atomistic and holistic approaches," can it even have substantive boundaries? In this chapter we elaborate our interpretation of the holon and the reasons that it offers a useful alternative to systems as an ontology with which to analyze agricultural endeavors. We argue that the holon offers a fresh perspective on questions of boundaries and sources of change in agroecosystems, and on the great variety of farms and their pathways to persistence. Finally, we believe that holon agroecology offers opportunities for the multidisciplinarity that is essential for sustaining and improving the agricultural endeavor.

8.2 INTRODUCTION TO THE HOLON

The holon is simultaneously a part and a whole. Its wholeness is manifested by its capacity for self-governed action, such as when the authors decide to have lunch together lakeside on our campus. Each of us is a whole in the sense that we can decide to do this on most—but not all—days. There are some times that because we are also parts of larger wholes, such as our university, community, and families, we are constrained by our partness, for example, one of our departments may require our participation in a meeting. To most richly understand our noontime behaviors, an observer would need to understand that we have considerable autonomy as wholes, but are often constrained because we are at the same time parts. Similarly an analyst would see the successful farmer acting and planning with appropriate autonomy, but operating within bounds specified by the *ecology of contexts* in which the farm exists. The farmer has an array of options to exercise, but not an infinite number, sharply limited, for example, by the imperative to choose crop species that are adapted to the local climate, or to grow products for which there is a market. We more fully explore this ecology of contexts below, but the usefulness of the holon is to keep foremost in our vision the idea that in order to most richly comprehend many interesting things in biology and society we must simultaneously be aware of both their wholeness and their partness. We have suggested (Bland and Bell 2007) that we might usefully learn to "flicker" between seeing a holon in its wholeness and as a part of an ecology. Our flickered imagining of farm holons helps us see the self-governed whole, as well as the constraining (and enabling) ecology of contexts that so powerfully shape what happens on the farm.

If we are to speak of the wholeness of the holon, there must exist some surface that bounds it, allowing us to envision it as a whole, while simultaneously a part of its ecology of contexts. The problem of where to draw boundaries within systems depictions is long-standing. In a practical sense, in order to study some facet of agriculture the analyst must design a bounded experimental system (Norgaard and Sikor 1995). Consider corn breeding as an example: test plots are typically planted and maintained at multiple sites across a region by a trained and dedicated crew of graduate students. But the hybrids in the experiment are isolated from potentially significant aspects of the actual farms, for example, the challenge of timely planting when there is so much else to be done, or poorly functioning machinery. On-farm research seeks to expand the boundaries of the system to incorporate more of the contexts in which the genetic technology must operate, but boundaries remain present, separating the experiment from the whole of what actual farming involves.

We propose that *intentionality* provides a useful bounding surface for holons. A farmer's intention is (at least in part) to plan and act so as to permit the farm holon to persist and provide livelihoods. Thus, we imagine the farm holon as including the decision makers and the biological, physical, social, economic, and human resources that these managers manipulate and exploit. Some of the components of the farm holon are themselves holons, such as workers, family members, or cows, while others such as tractors and fence posts are not. Thus, holons may be envisioned as *intentionalities* operating in the world—entities that act so as to further goals they possess. What might be understood as intentional behavior ranges from our decision to enjoy a lunch break through phototropism in plants, but we have not found it necessary or useful to attempt to put too fine an edge on what we mean by intentional. Our concern here is with humans doing agriculture—planning and acting to cultivate livelihoods from plant and animal increase—so the degree to which behaviors are understood to be encoded in genetic information is not a concern.

Thus, holon agroecology sees farms as intentionalities consisting of other intentionalities and inanimate material, embedded in an ecology of contexts. This appeal to intentionality as a bounding surface helps us see the farm's wholeness, and reminds us that any agroecosystem analyst should recognize that understanding why a farmer does what he or she does must acknowledge that the farmer is acting on a set of goals that may be impossible to fully articulate in a shared language. Seeking a reasonable return on investment is surely part of the intentionality of many farmers, but things become far more diverse after that. A farm's intentionality might additionally be shaped by love of a particular place, spiritual notions of stewardship, an interpretation of animal sentience, and visions of a better future for the children of the farm family. Yet it seems unimaginable that such a complex stew of influences can be resolved to a clearly defined intentionality. The default assumption should be of *ununified* intentionalities—farmers, like all of us, are typically conflicted, and a simple model of their intentionality, for example, profit, is often misleading. The lack of unity that a farmer-as-holon experiences is even plainer when we consider the farm as a holon, including the intentionalities of the members of a human farm family, livestock, plants, and their human and nonhuman community relations. Although such ununified intentionality may frustrate efforts at reliable analysis, it is a well-spring of novelty and innovation. Indeed, the authors' hope for a more equitable, resource-efficient, and multifunctional agriculture fundamentally depends on the great diversity of intentionalities held and acted upon by farmers.

8.2.1 The Holon's Ecology of Contexts

While intentionality speaks to wholeness, the partness of holons arises because they are *embedded in and help create* an ecology of contexts. A great many contexts in which farms exist are readily envisioned: climate, soil, market access, labor costs, spiritual beliefs, health of household members, debt, and the cost of energy. The farm holon is constrained by many of these contexts, and often helps constitute them. For example, the climate and soil of a place impose a considerable set of constraints on the species that will flourish there; hence farmers do not grow bananas in Wisconsin. Religious tradition is a context that makes Amish farmers unwilling to use certain agricultural technologies, just as swine are uncommon in predominately Islamic countries.

There are other contexts for which farms are constitutive, like the market for corn. The corn market appears as it does in part because of the farms that, for whatever reasons, grow the crop. There are other components to the corn market, of course, for example, demand, and over a century of research and development about how to grow and put it to use. Farms in many cases coevolve (Norgaard and Sikor 1995) with a context, and thus are at different times constrained by it and constitutive of it. An example is labor on Wisconsin dairy farms—these farms have been able to evolve toward herds in excess of 1000 cows in part because of the availability of immigrant labor. The social context in rural Wisconsin for these workers changed to include welcoming ethnic restaurants and markets, perhaps making the employment opportunity more attractive. Thus, the pool of workers expands as the state's dairying system becomes more dependent on their labor.

The theologian Reinhold Niebuhr wrote a famous prayer asking for the wisdom to discern situations that we can change from those that we cannot. In terms of holon agroecology, contexts differ greatly in the degree to which farmers can affect them in the direction of their own intentions or, in sociological terms, can be said to have *capability* with respect to the context (Bland and Bell 2007). There are clear examples where farmer capability is completely lacking, or nearly so, for example, climate or soil texture, and there are some for which there is considerable potential for impact. Many farmers can influence the organic matter in their soil through reduced tillage and crop rotations that include perennials, and this organic matter in turn changes water and nutrient dynamics in the soil. Thus, these farmers have some capability with respect to facets of their soil context. Similarly, treatment of labor may make a farm a more or less desirable place to work, influencing the pool of workers available to the particular farmer. Innovative farmers can foster markets for their production, for example, farmers' markets and community-supported agriculture.

There is a substantial literature on farmer capability, often using the much-debated language of "agency," recently summarized by Higgins (2006), who argued for two main strains of thought: "agri-food globalization theory," and "the actor-oriented approach." Holon agroecology accommodates the first as market contexts in which the farmer has little capability; for example, transnational food corporations have so powerfully determined what will be purchased that what farmers can profitably produce is quite conscribed. Such contexts in holon agroecology are envisioned as *stabilized externally to the farm*, and thus must be taken by the individual farm largely as given. Some of these contexts are stabilized by entities that are themselves holons, for example, agrifood corporations, planning and acting to persist and grow, and among their strategies is to structure markets so that individual farmers see clear and few choices.

Actor-oriented perspectives of farmer capability place emphasis on social relationships, and the interactions that advance each actor's "project." This too is readily accommodated in holon agroecology, as the farmer recognizes opportunities (or imperatives) for planning and acting in those contexts in which social negotiation is central, such as obtaining credit. The capability a particular farmer experiences may be closely tied to his or her social skills. As well, the very intentions of the farmer largely derive from her or his experience of the ecology of contexts: we intend what seems reasonable to us, and reason is always contextual if it is reason at all. But as the actor perspective emphasizes, there are nonhuman components involved in the success of a farm (the actor's project) as well, from the weather to crop susceptibility to disease. Persistence of the farm holon depends on good fortune in avoiding calamity, as well as the farmer's reasoning and perseverance, perhaps emerging from a relatively unified intentionality.

One place of development beyond the actor-oriented approach, though, is holon agroecology's insistence on the importance of intentionality. Perspectives such as Actor Network Theory (ANT) emphasize the equivalence of human and nonhuman actors as, in the terminology of ANT, *actants*. The ANT goal here is worthy: to encourage the conceptual engagement of the human and nonhuman. But the presence of intentionality in some actants and not others, as well as the variety of character and orientation of these intentionalities, suggests that some additional theoretical tools are needed if we are to understand how holons persist in their ecology of contexts.

8.2.2 The Holon as Narrative

Agriculture is an immensely complex human endeavor, connected to more things in more ways than we can ever know, let alone describe to another—human survival, culture, and livelihoods, as well as the fates of nonhuman species, to start a list at a very coarse level. In order for us to communicate with one another about some particular aspect of agriculture, that is, to develop shared perceptions of selected phenomena, we need to make choices about what of its infinite involvements to include in the discussion. In doing so we are crafting a narrative, and this idea is so helpful and important in holon agroecology that we must explore it a bit at this point.

Ultimately, we make sense of what we do and experience, and communicate this appreciation with others, through stories. In creating these stories, or narratives, we must exclude much—that is, make narrative choices. In one sense this is a practical decision: the present authors have a few thousand words in which to share our ideas about the holon as a useful tool for agroecology. To do this most effectively for the audience we anticipate here we chose not to explore its links to philosophical phenomenology, or relationships to issues of power, or contrast it with systems thinking beginning with von Bertalanffy. We all make such decisions within every scholarly communication we create.

But crafting narratives is more than wise communication strategy. Allen et al. (2005) argue that narratives are the only way that truly complex systems, such as ecosystems, can be meaningfully addressed. For them, "The power of narratives is that they can relate in a coherent way contrasting types of things from different scales. Narratives are the device people use to grasp large ideas. Models can be used to calibrate things, and even improve the quality of narratives, but models cannot work with the scope natural to a narrative." We submit that the scope of the issues of true significance in agriculture requires narrative, that is, results of this or that experiment, have meaning only within a larger story.

Elsewhere we use the term narrative in reference to a particular aspect of the challenges of defining system boundaries (Bland and Bell 2007). The narrative boundary problem arises because we can effectively tell but one of the many stories that might be told about a set of items and events. A

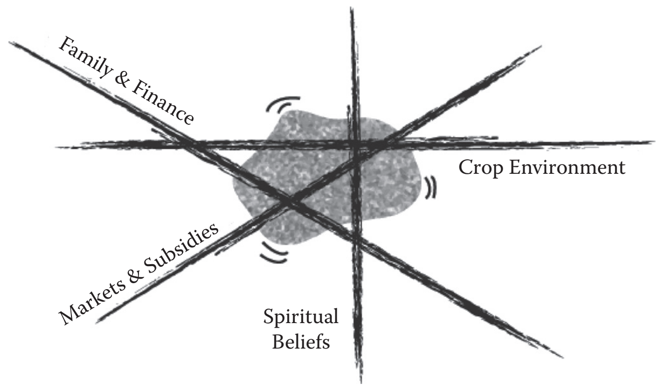

FIGURE 8.1 The farm holon as an entity embedded within and constitutive of an ecology of contexts. The constantly evolving configuration of the farm must be valid in all contexts, although tensions likely exist. The intentionality of the farmer to have the operation persist bounds and animates the holon. (From Bland and Bell, 2007. *Intl. J. Agric. Sustain.* 5(4): 280–294. With permission.)

particular farm holon is part of stories about biogeochemical cycling, local livelihood opportunities, and the quality of life of sentient beings. So narratives are essential to understanding and describing complex systems, and their telling necessarily involves choices about what is relevant to the problem at hand, and, as a result, many parts of the holon remain unacknowledged. The holon idea provides some basic conceptual tools for making and recognizing narrative choices: intentionalities, capabilities, and contexts.

8.2.3 Persistence of the Holon

The ability of the holon to persist (at least long enough for some observer to notice it) depends on its ability to find a configuration—some way of doing business, of choosing and organizing activities—that is simultaneously viable in the many facets of its ecology of contexts (Figure 8.1). Within each of the myriad contexts in which the farm holon exists, such as personal values or soil hydroclimate, there are likely several solutions that are viable, but as additional contexts come into consideration the valid configurations inevitably become fewer.

When the holon fails to persist it may be because the premise of the farm was wrong or that over time one or more contexts change. As much as the community-supported agriculture farmer may cherish living on a pesticide-free farm where his or her children need not be occasionally warned to stay away from the garden, the limits to what folks are willing to pay months in advance for vegetables not yet planted may not be enough to cover the cost of health insurance for a growing family. For farmers in Illinois changing contexts might include the price of soybeans falling as new Brazilian lands come into production, or damaging soil insects that increasingly survive a rotation that formerly kept their populations low. Regardless, the farm holon must change or perish.

While clearly individual farms do find viable solutions in their particular ecology of contexts, none of these solutions is free of internal tensions—viable here means only that particular contexts do not exercise veto power over the project. Tensions within every solution seem likely because a holon's intentionality is rarely unified—any solution is a balancing of at least partially oppositional desires and capabilities with regard to the ecology of contexts. Additionally, an "optimal" solution cannot be calculated because some of the contexts of a farm's ecology are incommensurable; that is, they cannot be directly compared using a single unit of measurement. Much of ecological economics is about addressing the incommensurability of, for example, ready access for urbanites to a stream that supports trout fishing compared to the costs to farmers of mandating particular manure management practices. For the individual holon incommensurability means that many trade-offs can only be understood intuitively, and thus remain always subject to rethinking, for example, the need for labor of farm household children compared to the possibility of injury (Zepeda and Kim 2006). But the search to relax these tensions surely serves as an important source for innovation and change. Here the holon in its unending need to reconfigure as contexts change, and the ever-present impetus to reduce tensions reminds us that farming is not, and can never be, a completely connected-up, finished system. Holon agroecology offers a way to envision both the motivation for and sources of change (Bland and Bell 2007).

8.3 THE VARIETY OF FARMS

The holonic ecology of contexts and imperative for constant reconfiguration offers an explanation for the tremendous variety of farms. Every holon's ecology of contexts is unique, because of location and accidents of history, both personal and environmental. And this unique contextual environment can be seen as only the starting place from which the holonic search for viable configurations leads to ever-increasing diversity of extant solutions. This is the "contextualism" identified by Norgaard and Sikor (1995), in which "phenomena are contingent upon a large number of factors particular to the time and place."

No two farms are identical, yet depending on the problem at hand (i.e., a set of narrative goals) there may be recognizable types, that is, particular configurations that can be seen repeated (although never identically) among the population of farms. Andow and Hidaka (1989) identified "syndromes of production," in which he suggested very diverse strategies for growing rice in Japan could be thought of as integrated packages of practices (some much more intriguing than others to them as ecologists). Giampietro and colleagues (Pastore and Giampietro 1999; Gomiero and Giampietro 2001) developed typologies of small-area farming systems in Vietnam and China based on goods produced, and time and land allocations among a set of activities found to be commonplace in the study regions. Dixon and Gulliver (2001) proposed descriptions of dominant farming systems across much of the world. Eakin (2005) interpreted Mexican farm holon configurations in a "livelihood strategies" framework, identifying four in her study regions. Importantly, though, what characteristics are taken into account in describing a type or strategy is a narrative issue. The analyst makes choices about what factors make farms similar or dissimilar, based on the question at hand, or the data available, and perhaps in ignorance of important issues.

In holon agroecology we interpret these identifiable types as *resonant configurations*. The existence of resonance suggests that for a place and era there may be a limited number of holonic configurations for which there is a contextual "sweet spot" of supportive reverberations. It is not that other configurations of crops, practices, land tenure, and inputs would not work in a region, but that extant farm configurations tend to cluster around a particular set of possibilities. These are partially analogous to "attractors," "domains of attraction," "alternative steady states," or "multiple equilibria" described for ecological systems. The classic example is that of temperate freshwater lakes, typically observed in either an oligotrophic (clear) or eutrophic (turbid) state. Some ecosystems are thought to switch rather abruptly from one such state to another (Scheffer 1999) in the face of continuing stress, for example, increasing P pollution in the case of the oligotrophic lake. The ability of the ecosystem to resist such switches, and thus remain in a particular state in the face of stress, is termed *resilience*, "the capacity of a system to experience shocks while retaining essentially the same function, structure, feedbacks, and therefore identity" (Walker et al. 2006).

A resonant farm holon is relatively resilient to perturbations in its ecology of contexts. Thus, the community-supported agriculture model provides the small-scale vegetable farmer a buffer against failure of a particular crop that the contract grower, committed to delivering 1000 squash on a certain date, does not enjoy. Similarly, government commodity price and weather disaster relief programs for crop and livestock producers soften the impacts of years of bumper crops or droughts. In a biophysical example, deep silt loam soils provide a larger soil water reservoir than do sandy soils, making a crop resilient to rainfall shortages. A large-scale dairy is nearly immune to the health of individual milkers, in marked contrast to a small farm operated by family labor, where injury to a household member can force a considerable reconfiguration of the operation. Antle et al. (2006) demonstrated multiple equilibria in farm productivity arising from the inherent productivity of land, and when, if ever, a farmer decides to make soil conservation investments.

Farms that are quite unlike any notional resonant configuration, that is, appreciably different from others in one or more ways, may be so because of some accident of history, an innovation, or "sunken capital"—infrastructure that generates return with only one set of (potentially obsolete) production practices. In the Wisconsin dairy industry two distinct resonant configurations are readily posited: large-scale confinement facilities in which milking proceeds around the clock by hired labor, and rotational grazing farms. Constituting the vast majority of the 15,000 dairy farms in the state, however, are relatively small (about 100 cows) confinement operations on which the family members supply most of the labor. Lively debate surrounds the future of this vast majority, which are currently declining in percentage terms while the others rise. Are there many viable configurations of dairy farms in Wisconsin, or are those not moving toward one of the two posited resonant configurations in grave danger? Alternatively, might there be under way shifts in the context ecology that few dairy farms or analysts yet appreciate, and that will lead to emergence of new resonant configurations?

But we wish to avoid a top-down sense of system control and determination. The sweetness of a resonance is something each farm holon must judge, listening in its own way, repositioning accordingly, and even discovering and shaping. Thus, the resonance of a farm holon depends on finding a configuration in which multiple contexts are at the least in the same key, as it were.

8.4 HOLON AS A TOOL FOR INTERDISCIPLINARITY

The scholarship of agriculture entails diverse disciplinary perspectives and traditions. Each offers useful and important insights and tools to the agricultural endeavor, but each operates from a unique narrative; for example, soil scientists tell the story of the productivity and health of the soil resource, often abused by human actions, while the sociologist tells the stories of the humans in the diversity of rural settings. The fundamental incommensurability of these narratives is the reason that we have disciplines at all, and each contributes uniquely to a rich understanding of agriculture. Disciplinarity should (and most certainly will) persist in the academy.

Distinctions among these disciplinary narratives are of little concern to stakeholders in the agricultural endeavor, however. The diverse challenges facing agriculture are widely understood to require multidisciplinary approaches, and we propose that holon agroecology offers a powerful tool for this task. The farm holon is a nexus of contexts, and for each of these contexts there is a discipline that is, we trust, cultivating useful and applicable knowledge. Thus, the farm holon offers a meeting place for the disciplines, where each must acknowledge the (at least potential) significance of the others for shaping the what and why of farmer behavior. Choices inexplicable to one discipline (why such big tractors?) are made a bit more understandable by the recognition that the farm holon is shaped by and held together by a complex stew of intentionalities (including garnering respect of peers). We argued earlier that our proposed definition of agriculture as the cultivation of livelihoods from plant and animal increase rightly places the farm holon at the center of the discussion, and it is here that the disciplines can and should articulate with one another.

Holon agroecology begins with the assumption that diverse and even surprising contexts—and thereby disciplinary domains—may be of significance in the farm's unique configuration. We hope that this will make it easier for each discipline to be open to, if not curious about, how its perspective must be applied as a result of other contexts. Again, Norgaard and Sikor (1995) anticipated this necessary "pluralism" in disciplinary approaches. Holon agroecology is complementary—rather than an alternative—to systems thinking as a multidisciplinary approach. The diverse tools of systems portrayals and modeling (e.g., Spedding 1988; Wilson and Morren 1990) are essential for understanding particular contexts; for example, numerical models are arguably the only tractable way of exploring the intersections of soil, climate, and agronomic practice, just as crop calendars help envision the temporal nature of labor requirements. Holon agroecology provides a complementary perspective by placing the context-specific insights provided by systems tools in a broader framework of the agricultural endeavor understood as fundamentally motivated by the play of intentionalities in an ecology of contexts. This seems to us to have potential to help disciplinarians better appreciate the limits of their own perspectives, and to delay normative judgments, as one context helps illuminate the motivating influences for what seems wrongheaded from another perspective.

8.5 SUMMARY

Holon agroecology provides a framework for agroecosystems analysis that is, we propose, complementary to systems thinking. Systems thinking usefully demonstrates important linkages within agriculture and between it and other sectors of society, but the disconnects are important as well. These disconnects are both the source of the endless variety and innovation, as well as the innumerable bad ideas, manifest in the agricultural endeavor. Holon agroecology provides a framework and vocabulary to envision why farmers do what they do, and how farms persist in a world of constant change through the relentless search for viable solutions in an ever-changing ecology of contexts. Holon agroecology provides a meeting place for the diverse disciplinary perspectives that are essential, yet each alone inadequate, to making manifest the possibilities of a multifunctional, equitable, and resource-efficient agriculture.

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Section III

Ecological Foundations of Agroecosystem Management