

## **Fundamentals of Environmental Responsibility Ensuring a Sustainable Environment for Global Food Production<sup>i</sup>**

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Globalization of the food system has put global food security at greater risk than at any time in modern history. In striving for ever greater economic efficiency, it has become increasingly vulnerable to chaotic disruption and even potential collapse. The “Panarchy theory” of ecological systems dynamics seems to characterize the current global food system quite accurately.<sup>1</sup> This theory was developed by systems analysts Buzz Holling and Joseph Tainter in the 1970s to describe the natural behavior of ecological systems. It purports to explain the evolution of complex ecosystems, including what makes systems resilient and adaptive as well as what makes them vulnerable to catastrophic collapse. They believe the same ecological principles apply to social and economic systems as well.

As natural ecosystems develop, they evolve toward increasing “complexity,” meaning an increasing number of more highly specialized functions. As systems become more complex, the internal dependencies among the specialized functions also increase, which Holling and Tainter refer to as increasing “connectivity.” Increasing complexity and connectivity increase the efficiency of systems by removing redundancies both within and among the various systems functions. However, as the redundancies are removed, systems lose their natural resilience and adaptability and become more vulnerable to outside shocks as well as less able to respond to fundamental changes in their environment.

Highly specialized functions lack the versatility needed to respond to new challenges or threats. Internal dependencies also allow the consequences of outside shocks to spread through the entire system more quickly than for less “connected” systems. Every specialized function within the system must change to accommodate a fundamental change in the environment. Consequently, highly efficient systems are also highly vulnerable to collapse.

Natural ecosystems are self-making and self-regulating and evolve *naturally* toward a state of complexity and connectivity. Social and economic systems, on the other hand, are created and regulated by people. In the purposeful pursuit of greater efficiency, economic and social systems become increasingly dependent on highly specialized technologies and methodologies as the systems become more “complex.” Systems also resort to increasingly comprehensive regulatory

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controls to remove inter-functional redundancy as they become more “connected.” As with natural ecosystems, economic and social systems become less resilient and less adaptive as they become more efficient. More efficient economies and societies are more vulnerable to collapse.

The global food system has many of the characteristics of complex, interconnected, regulated systems described in Panarchy theory. The evolution toward an increasing complex and connected global food system is well known within the industry and has been extensively documented in recent books such as *The End of Food*<sup>2</sup> and *America's Food*.<sup>3</sup> The increasingly popularity of “just in time” delivery has resulted in only three-to-five days supply of many food items in the food system at any one time. Any major disruption of the global food distribution system could have catastrophic consequences. The dramatic rise in food prices in 2008 was indicative of the potential impact of a significant shortfall in any major crop can have on the food system as a whole. In 2008, the trigger was the diversion of corn to ethanol production.

Few people are aware of the extent of corporate control of the global food system. Many of the largest seed companies, agrichemical companies, and food processors have established joint ventures, strategic alliances, and various contractual arrangements that effectively consolidate control of the total system without consolidating ownerships. The various systems functions – production, processing, and distribution -- have become increasingly connected and mutually dependent. Extensive industry studies by Mary Hendrickson and Bill Heffernan of the University of Missouri indicate that control of global food systems is now centered in five or six corporate “global food chain clusters.”<sup>4</sup>

Historically, open markets at various functional levels gave food industry participants a degree of versatility and sovereignty in marketing their products. Most of these markets have been replaced with various contractual arrangements. The arrangements allow the large global food retailers and processors to exert extensive regulation and control over the food system by simply exerting their economic and political power. The food system appears to be in the final stages of both efficiency and vulnerability, as described by Panarchy theory.

As the global food system has become more efficient, it has become more vulnerable to unanticipated shocks, such as increasing food safety concerns and rising energy costs. It also has lost its ability to respond to fundamental changes in its market environment, such as increasing consumer and public demand for greater ecological and social responsibility. The potential for continuing short run shocks and long run challenges will require fundamental changes in the current system of global food production and distribution. The question is whether the current system is capable of enduring the shocks and responding to the challenges.

The economic, ecological, and social crises of today are awakening people to their interconnectedness with the other living and nonliving things of the earth. For example, the high gasoline prices in 2008 awakened many people to our continuing dependence on the earth for fossil energy. Even the major oil companies now admit that we are at or near a peak in global oil production. The remaining oil reserves will be more difficult and costly to retrieve and thus will be more scarce and expensive. Fossil energy from other sources is expected to follow a similar pattern, peaking and dissipating over the next few decades.

Global climate change has awakened people to our ability to destroy the livability of the earth. Greenhouse gasses are released into the atmosphere whenever energy is released from a biological source, including the fossil energy in oil, natural gas, and coal. So, we can't use the earth's remaining stocks of fossil energy without exacerbating the challenges of global warming. Pollution of the natural environment with industrial chemicals – including the soil that grows our food, the air we breathe, the water we drink – threatens human health and the future of humanity.

People are just beginning to awaken to the social crisis that confronts today's industrial societies. At no time since the “gilded age” of the early 1900s has the gap between the wealthy and the rest of us been so great. The income of the top one-percent of Americans now amounts to more than the total income of the bottom one-half. In the words of Alan Greenspan, former Chairman of the Federal Reserve Board, “The income gap between the rich and the rest of the U.S. population has become so wide, and is growing so fast, that it might eventually threaten the stability of democratic capitalism itself.”<sup>5</sup> The economic gap between those in the rich and poor nations of the world is growing even faster and wider.

The current global economic recession is a direct consequence of extraction and exploitation of the earth and its people. All economic value comes from either the earth or society. The economy itself produces nothing of value; it simply facilitates our individual relationships with each other and with the earth. Human imagination and creativity is worth nothing without minerals, energy, and other resources from the earth. Imagine today's modern technological society without fossil energy and you get some idea of our dependence on nature. In addition, the people creating today's technologies have been nurtured, civilized, educated, socialized, and organized by families and communities – by society.

These are but a few of the challenges that confront today's global food system. In response, a large and growing number of consumers are demanding greater environmental and social responsibility in the production and distribution of their foods. The food industry and government both have been slow to respond to these growing demands, but eventually will be forced to do so. Increasingly, people will demand safe and healthful foods that not only are affordable for all people of all countries of the world, but also foods that are produced in ways that protect the ecological and social integrity of nature and society.

Equally important, an increasing number of people are willing and able to pay the economic costs associated with creating a new ecologically and socially sustainable food system, including those costs currently “externalized” or imposed on nature and society. A major obstacle in achieving sustainability is the ecological vulnerability of the current global food system and its inability to respond to fundamental changes in its economic and political environment.

One reflection of these new consumer demands has been the emergence of the “fair trade” movement. Fair trade attempts to establish trading partnerships based on dialogue, transparency, and mutual respect, rather than relying solely on markets.<sup>6</sup> The initial objective of fair trade was to provide market opportunities for producers who had been denied access to global markets by their small size or their commitment to traditional production practices. The movement began with various native crafts but became more successful as it expanded into food products. Initial success in marketing fair trade coffee led to expansion into tea, chocolate, sugar, vanilla, fruit,

wine, and other food products. Growing concerns for environmental and social responsibility is allowing fair trade to continue to expand rapidly both in variety and volume of products.

Merchants who buy and sell Fair Trade Certified products must agree to four basic principles: pay prices high enough to cover the costs of sustainable production, pay a premium that producers can invest in community development, pay at least partially in advance when producers request it, and sign contracts that allow for long-term planning to ensure ecologically and socially sustainable production. Based on these principles, the Fair Trade Labeling Organization establishes specific standards for individual products.

The World Fair Trade Organization and Fair Trade Federation of North America provide third-party evaluations of producer and marketing organizations to ensure their full commitment to fair trade principles. Member organizations must verify their commitments to: transparency and accountability; respectful relationships, capacity building, and market opportunity for marginalized producers; basic labor rights and empowerment of workers; environmental stewardship, and cultural respect. In summary, Fair Trade is an attempt to ensure both social and environmental responsibility.

While fair trade provides a useful model it was not intended, nor is it adequate, to transform the global food system in total. In fact, fair trade is specifically targeted to those who have been marginalized and excluded from global food markets. While this was and is a worthy objective, the challenge today is to transform the entire global food system, not simply provide access for marginalized producers. The basic principles of fair trade must permeate the entire mainstream of food systems to achieve ecological, social, and economic sustainability.

A good place to start the process might be to start a dialogue among those who are currently concerned about the sustainability of the global food system. This dialogue must take place in an environment that fosters openness, transparency, and mutual respect. The initial focus of the dialogue might be to develop a subjective assessment of the *ecological* vulnerability of the current food system. The global food system is simply too complex to allow an objective, quantitative assessment of its sustainability, in spite of continuing efforts by some to do so. As with all complex systems, such as fossil energy depletion and global climate change, statistics can provide compelling evidence but can never provide complete proof.

A set of indicators of environmental responsibility could emerge from such a process, perhaps based on the “four Rs” of ecological sustainability: resistance, resilience, regeneration, and responsiveness. Resistant systems are capable of absorbing shocks, resilient systems are capable of recovering, regenerative systems are capable of renewing and reproducing, and responsive systems are capable of evolving to accommodate fundamental changes in their environment. Ecological indicators of *agricultural* sustainability might include:

- soil fertility and its vulnerability to erosion and degradation through cultivation
- water quality and its vulnerability to chemical and pollution and depletion through cropping and irrigation
- air quality and its vulnerability to pollution with noxious odors and greenhouse gasses
- biological and agro-ecological diversity of microorganisms, insects, plants, and animals

- renewable energy use and ability to respond to changing natural resource constraints

The same basic principles, using appropriate indicators, could be applied to the entire food system. Water pollution and depletion, for example, are just as relevant to food processing and distribution as to food production. Air pollution is even a greater challenge in food manufacturing and transportation than in food production. Current reliance of the global food system on fossil energy is perhaps the greatest challenge at all levels in the system.

Any set of indicators of environmental responsibility must include indicators of fossil energy dependence. Industrial development is inherently dependent on abundant sources and inexpensive energy – first forests, then coal, and now oil and natural gas. We are not necessarily running out of fossil energy, but the abundant and inexpensive sources of fossil energy are gone. In addition, fossil energy use is a major threat to environmental degradation, including global climate change. The continuing depletion of fossil energy necessitates fundamental change in the global food system.

Regardless of the specific indicators eventually selected, specific measures for each indicator will be required to guide and validate the transition from industrial development to sustainable development. The establishment of indicators and measures of environmental responsibility, however, is only a beginning step toward ensuring a sustainable environment for global food production.

In the early 1980s, Stuart Hill of the University of Western Sydney in Australia developed a model for ecological change, which he called “ESR” model: Efficiency, Substitution, and Redesign.<sup>7</sup> The efficiency approach involves finding more efficient solutions to problems. Increasing the efficiency of energy use or finding more effective means of removing pollutants from air and water are typical examples. Many such solutions may be profitable as well as more ecologically efficient, as has been pointed out by advocates of “Natural Capitalism,<sup>8</sup>” the “Triple Bottom Line,<sup>9</sup>” and other approaches to ecologically responsible management.

The current industrial food system is very ecologically wasteful and many of the wastes not only threaten the natural environment and human health, they also waste money. Many of these wasteful practices are continued not only out of habit but also because highly complex and interconnected systems are quite difficult and costly to change. Even if environmental changes promise significant economic benefits for the system as a whole, in this highly complex, connected system, when one changes, all must change. For some parts of the system, the costs of change may outweigh benefits. In addition, lacking effective competition from more resilient and flexible alternatives, there is no economic necessity for change.

Whereas “efficiency” focuses on *improving* current inputs and methods, “substitution” involves *replacing* current inputs and methods with less degrading and destructive alternatives. Replacing chemical fertilizers and commercial pesticides with cover crops, crop rotations, and more intensive management of crops and livestock are farm level examples of substitution. Replacing fossil energy with energy from renewable sources – wind, water, and photovoltaics – is an example applicable at all levels in the food system.

However, as Hill points out, systemic problems, such as lack of sustainability, can only be solved by “redesigning” the system so the problems addressed by “efficiency” and “substitution” do not continue to arise. In some cases, redesign means starting over. Redesign addresses the underlying sources of problems by changing the basic structure and functioning of the system as a whole. The lack of sustainability of the global food system is systemic; the whole system must ultimately be redesigned.

The efficiency and substitution approaches are logical stepping-stones or stages in a progressive process toward systems redesign and ultimate sustainability. However, they can also be barriers to sustainability. Efficiency may create the impression that all environmental solutions are profitable; they are not. It's ultimately cheaper to extract and exploit than to renew and regenerate. The premium that economic value places on the present relative to the future also makes short-run *fixes* more profitable than long-run *solutions*. Thus, input *substitution* may make the current system appear economically workable or fixable, while the systems *redesign* needed for long run solutions appears economically infeasible.

Efficiency and substitution also appear to be relatively simple when compared with the task of redesigning the entire global food system. We are more used to dealing with symptoms rather than removing causes. *Symptoms* can be isolated, even within complex systems, and dealt with separately and sequentially. *Causes* are inherently systemic and beyond the scope of any specialized systems function. The good news is, “we” really don't have to redesign the global food system. If we change the principles by which the system operates, it will redesign itself.

The basic principles by which sustainable systems function are really quite simple. As Hill suggests, they typically involve returning to “the wisdoms of the ages and nature, including our own often untapped natural intelligence and intuition”<sup>10</sup> – our common sense. Agricultural examples of redesign strategies are evident in approaches such as Permaculture, Natural Farming, Ecological Farming, Biodynamics, Deep Organics, and Holistic Resource Management. All of these approaches are rooted in the basic ecological principles of nature.

The basic principles of healthy natural ecosystems include holism, diversity, and interdependence. Natural ecosystems gain their productivity through functional specialization and through integration of the functions of various species to create a synergistic ecological whole. As “Panarchy theory” suggests, natural ecosystems naturally evolve toward greater complexity and connectivity, to achieve greater efficiency. Consequently, natural ecosystems cannot attain maximum efficiency without becoming vulnerable to disruption and collapse.

Healthy natural ecosystems are *diverse*, which is fundamentally different from being *complex*. Diversity requires meaningful differences, both within and among systems functions. Diverse ecosystems are inherently versatile and adaptive; they have built-in functional and systemic redundancies. Functional versatility gives healthy systems resistance and resilience; they can withstand and recover from shocks at all functional or species levels by calling on unused capacities to function differently whenever necessary. They also have the ability to change the nature of their functional relationships without compromising the basic integrity of the system as a whole. Panarchy theory suggests that natural systems compromise their diversity as they increase in complexity and connectivity.

Healthy systems are also interdependent, meaning that relationships between the various functions within the system are mutually beneficial. Mutuality of benefits requires a degree of functional or species sovereignty or autonomy. Each must be able to survive, even if not thrive, without the others. As relationships become more “efficient,” they evolve from interdependence to dependence, meaning that one or both functions in a relationship lose their autonomy or sovereignty. Consequently they lose their ability to survive a significant modification or termination of the relationship. Panarchy theory suggests that natural systems compromise interdependence as they increase in complexity and connectivity.

While the biological, chemical, and ecological processes of nature are beyond human control, they are not beyond human influence. In fact, systems of food production are “managed agroecosystems:” they are natural ecosystems “managed” in such a way as to tip the ecological balance in favor of humans relative to the other species. Environmentally responsible food production requires that humans “manage” agroecosystems in ways that enhance their usefulness to humans, relying on holism for their productivity but also respecting the necessity for diversity and interdependence to ensure sustainability. Agroecosystems that are managed holistically to maintain diversity and interdependence will maintain their resistance, resilience, regenerative capacity, and responsiveness. They will have ecological integrity.

Ecological integrity does not require new sophisticated technologies or methodologies. We need only rely on “the wisdoms of the ages and nature, including our own often untapped natural intelligence and intuition.” If we respect the principles of healthy natural ecosystems – holism, diversity, interdependence – the global agricultural system will redesign itself. It will evolve toward the creation of a sustainable natural environment for the global food system.

Unfortunately, we can expect active opposition to any efforts to redesign the global food system. There are powerful economic and political interests in maintaining the status quo – not because the current system is more efficient, and certainly not because it is demanded by consumers, but because it is more profitable for those who currently control it. If the system were redesigned for sustainability, its control would be far more widely dispersed throughout the system, as would the profits.

If we are to develop a sustainable global food system we must bring together those who are currently concerned about sustainability and long run food security to initiate a process that ultimately will lead to a fundamental redesign of the system. The collaboration should reflect the interests of consumers, producers, processors, distributors, government, and industry, but natural opponents of systems change should not be allowed to dominate or derail the process.

Efficiency strategies are good places to start because the skeptics can be shown opportunities to increase profitability as well as sustainability. Substitution strategies can also be implemented without changes in the fundamental structure of the system. However, the ultimate objective of systems redesign must remain foremost in the minds of those providing leadership for the process. As the collaborative implements efficiency and substitution strategies, some participants will become aware of the necessity for systems redesign, others will resign themselves to its

inevitability, while others will continue to resist. Regardless, a collaborative process will be necessary because only through collaboration can we hope to achieve genuine sustainability.

Once environmental indicators and measures have been developed, a system for voluntary product labeling could be implemented, perhaps using Fair Trade Labeling as a model. Product labeling should focus on specific measures of environmental indicators rather than certification of minimum environmental standards. Flexible metrics of environmental integrity avoid the inevitable problems that come from attempting to standardize a dynamic system based on conditions at any given point in time. Flexible metrics also can accommodate geographic differences in agroecosystems and differing cultural, as well as individual, preferences. Focusing on measures, rather than certification, also encourage continual improvement, rather than rewarding migration to minimum requirements.

As in Fair Trade, third party verification will be necessary to ensure objectivity. However, ecological integrity is also dependent on the social and economic integrity of the food system and the personal integrity of the farmers, processors, and distributors who participate in the system. As with ecological integrity, there are basic principles of social and economic relationships that must also be respected to ensure sustainability. From these principles, social and economic indicators and measures can be derived and implemented, as in the case of Fair Trade. The same basic step-by-step process for achieving economic and social integrity can be used as suggested for achieving ecological integrity.

The fundamentals of environmental responsibility provide a foundation for sustainability. However, in the absence of overall ecological, social, economic – and personal – integrity, there is no way to ensure a sustainable environment for global food production. Fortunately, we have the capacity to create a new sustainable food system; we just need to find the courage to do it.

## End Notes

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<sup>1</sup> Thomas Homer-Dixon, *The Upside of Down: Catastrophe, Creativity, and the Renewal of Civilization*, Excerpted in *World Watch*, March/April 2009.

<sup>2</sup> Paul Roberts, *The End of Food*, (Boston & New York: Houghton Mifflin Co.), 2008.

<sup>3</sup> Harvey Blatt, *America's Food: What You Don't Know About What You Eat*. (Boston: The MIT Press), 2008.

<sup>4</sup> Mary Hendrickson and William Heffernan. "Opening spaces through relocalization: Locating potential resistance in the weaknesses of the global food system." *Sociologia Ruralis* 42(4): 347-369. 2002.

<sup>5</sup> Alan Greenspan, as quoted in *Christian Science Monitor*, "Gap Between Rich and Poor Gaining Attention," <<http://www.csmonitor.com/2005/0614/p01s03-usec.html>> , June 15, 2005.

<sup>6</sup> Fair Trade Federation, Certification and Membership, <<http://fairtradefederation.org/ht/d/sp/i/7780/pid/7780>> .

<sup>7</sup> Stuart Hill, Ecological pest control: confronting the causes. *International Journal of Biosocial Research* 6: 1-3, 1984.

<sup>8</sup> Paul Hawken, Amory Lovins, and L. Hunter Lovins, *Natural Capitalism*, (New York: Little, Brown and Company, 1999).

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<sup>9</sup> Bob Willard, *The Sustainability Advantage: Seven Business Case Benefits of Triple Bottom Line*, (Gabriola Island, British Columbia, New Society Publishers, 2002).

<sup>10</sup> Stuart Hill, "From Shallow To Deep Organics: More Than Just A Shift In Technology," *The Natural Farmer* [USA], Pp. 28-29: Winter, 2000: Revised May 2007.