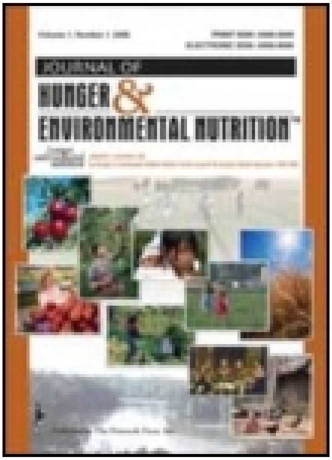

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Food as Relationship

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Food as Relationship

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ABSTRACT. Our modern food system is based on the same industrial principles as the rest of the industrial economy: specialization, simplification and economies of scale, and the principle objective is maximum production and short term return. Consequently the complex system of interdependent relationships is largely ignored. This paper illuminates some of the challenges confronting our current and future food security and related potential health consequences of this system and points to possible alternatives for the future.

KEYWORDS. Energy, food, health, soil, soil-to-health connection

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> What would happen, for example, if we were to start thinking about food as less of a thing and more of a relationship?
>
> —Michael Pollan

In his classic study on soil fertility, *An Agricultural Testament*,[1] first published in June 1940, Sir Albert Howard presented his case for connecting a series of problems in food and health to a failure in soil management. The key to proper soil management, he argued, was "the law of return"—returning all wastes to the land (preferably properly composted). It was the return of wastes to the land that insured proper levels of humus[2] in the soil. The effect of humus on the crop, and ultimately on human health, he asserted, is "nothing short of profound."[1] It is our failure to attend to this critical component of soil stewardship, he argued, that is the source of disease problems in the soil, plants, animals, and eventually ourselves.

In 1947, Howard published his second classic volume, *The Soil and Health*.[3] In it, he warned that the industrialization of agriculture was taking us in the wrong direction. Industrial agriculture, which focused on "quantity at all costs" by adding artificial fertilizers to the soil (the "NPK mentality"), paid almost no attention to the health of the soil. The lack of attention to managing soil for health, he argued, led to "mining the land," which he considered a "form of banditry."[3] The result is an "undernourishment" of soil and therefore of plants, animals, and ultimately humans. This led Howard to assert "a simple principle" that "underlies the vast accumulation of disease" that affects our world. That principle "operates in the soil, the crop, the animal, and ourselves" and "the power of all these four to resist disease appears to be bound up with the circulation of properly synthesized protein in Nature. The proteins are the agencies which confer immunity on plant, animal, and man."

Howard reminds us that nature evolved no means of shielding us from disease and therefore all of our efforts to develop therapies to ward off diseases are unlikely to keep us healthy. What did evolve in nature was the means to produce health-promoting foods from healthy soils that invigorate our immune systems, which, in turn, can keep us healthy.

Based on such ecological observations Howard asserted that if we were to manage our soils to "build up proteins of the right type," there would be "little disease in soil or crop or livestock, and the foundations of the preventive medicine of to-morrow will be laid."[3] Today, of course, we know that there are a complex set of nutrients in addition to proteins that are involved in healthy soil, but the overall principle that Howard proposed is still an interesting health-promoting option to explore. Simply stated, Howard proposed that proper soil fertility, which builds appropriate levels of humus in the soil, "is the basis of the public health system of the future."[3]

Since the amount of our disposable income that we spend on health care keeps increasing as the amount we spend on food decreases, it may suggest that Howard was right. The amount of personal income spent on health care for a typical United States citizen (when Medicare taxes are included) has increased to 18% while the percentage spent on food decreased to 10% (G. Swartz, e-mail communication, November 8, 2006). The percentage spent on food is provided by USDA's Economic Research Service and the percentage on health care was provided by Gary Swartz, MD, Mayo Clinic, Rochester, MN. The national average health care policy premium for a family of 4 is now between $10,000 and $12,000 per year and when Medicare payroll taxes [1.45% if employed, 2.9% if self-employed] and the part of federal and state taxes that go to support health spending are added, a person with an annual income of $60,000 pays 18% on health care.) Of course, undernourishment due to lack of income on the part of citizens living below the poverty line is clearly also a contributing factor to increased health problems.

It is rather astonishing that in the 60 years since Howard made his case for the connections between soil health and human health very little has been done either to substantiate or disprove his thesis.

While a few studies have been conducted to determine whether or not "organic" foods are more nutritious or health promoting than "conventional" foods, we have done very little to explore whether soils with appropriate humus levels have an impact on human health.

Since farms today can obtain organic certification simply by substituting natural for synthetic inputs, soil humus levels could be ignored just as easily on an organic farm as on a conventional farm. Given Howard's perspective, I doubt that he would have presumed any health-promoting effects in products from an organic farm that ignored humus enrichment. Injecting natural inputs while ignoring the "law of return" would still yield "artificial" returns. Hence, it would probably not have surprised Howard if such studies show mixed results.

The truly provocative idea in Howard's work is the notion that the quality of food and health is determined by relationships. Food is not an isolated thing—a mere commodity comprised of a list of ingredients or the numbers on a nutrition facts panel. Food always becomes part of the ecology from which it is produced.

FOOD IN THE INDUSTRIAL ECONOMY

The soil/food/health connection is not the only relationship we ignore in our modern food system. In fact, our modern industrial culture tends to view not only food but almost all of reality as a collection of fragments (things) rather than a web of relationships. Modern philosophers trace this tendency to the 17th-century scientific revolution. Rene Descartes wanted science to become a “universal mathematics,” which, of course, tended to reduce all of reality to measurable things and ignored dynamic relationships. It should not be surprising, therefore, that we have reduced our understanding of healthy food to an ingredient list.

Today, we are discovering the dysfunctional aspects of our tendency to reduce food to a thing rather than appreciating it as a relationship. The constant stream of (sometimes conflicting) recommendations suggesting that if we eat a sufficient amount of a particular ingredient (remember oat bran?) we will all be healthy is but one example of this disconnect with nature. Our failure to explore intertwined relationships between soil health and human health is yet another example of this same skewed food culture.

Our tendency to neglect relationships with respect to food has led us to ignore many of the unsustainable social, ecological, and economic components of our modern food system. That may well leave us ill prepared for the new food future that is about to descend upon us.

Our entire food system today exists within the general framework of the industrial economy. The industrial economy essentially operates like a bubble floating in space with unlimited natural resources entering the bubble to fuel the economic activities and unlimited sinks in nature to absorb its wastes. Our modern industrial food system is simply part of that same economy. Most of our food today is produced with nonrenewable fossil resources and we continue to expect nature to absorb the wastes emanating from our food system despite the fact that hypoxia zones are appearing throughout the industrial world—one of the largest in the Gulf of Mexico.

Herman E. Daly has long argued that this is the basic flaw in the industrial economy. He has warned that we must come to terms with the fact that our human economies are, in fact, subsystems of larger ecosystems and must function within those constraints.[4]

Since the natural resources that have fueled our food and agriculture systems are now in a state of depletion, and nature’s sinks are saturated, Daly’s assessment of our finite economy is about to impose itself upon our food system. The bubble will soon deflate.

There are at least 4 natural resources that have fueled our industrial food system that are now in steep decline: energy, climate, water, and soil.

Most of the energy that is used to produce and process our food comes from fossil fuels.[5] The nitrogen used for fertilizer is derived from natural gas. Phosphorus and potash are mined, processed, and transported to farms using petroleum-based energy. Pesticides are manufactured from petroleum resources. Farm equipment is manufactured and operated with petroleum energy.

Furthermore, cheap energy in the form of fossil fuels offers a comparative advantage to large, concentrated monocultures that are energy intensive. Cheap energy is then used to ship commodities to similarly large concentrated processing facilities where modern food processing is equally dependent on fossil energy. Having centralized the production and processing of most of our food, it also must then be shipped thousands of miles using petroleum energy to reach the end customer.

Our modern food system may be labor efficient, but it is one of the least energy-efficient food systems known. Anthropologist Ernest Schusky reminds us that from an energy efficiency perspective, hunting and gathering were not such bad ways to feed ourselves.[6] We simply gathered food, prepared it, and ate it.

Approximately 10,000 years ago, with the advent of the Neolithic Revolution, we began domesticating plants and animals. While such agricultural practices were much less energy efficient than gathering, they allowed our ancestors to live in settled societies instead of hunting a region's resources to depletion and then moving on.

The more significant shift in our food system occurred much later. Around 1930 we embarked on a new era of agriculture, which Schusky calls the "neocaloric era" because it is based almost entirely on "old calories"; namely, fossil fuels. The defining characteristic of our modern food system is that it replaced human and animal energy with fossil fuel energy. But from an energy efficiency standpoint, it is the least effective food system we have ever designed. Industrialization yielded a food system that for the first time consumes more energy than it produces. Schusky cites one egregious example—it takes "about 2200 calories of fossil energy in order to produce a one-calorie can of diet soda," which he suggests is "downright embarrassing to human intelligence."[6]

Fossil fuels are indeed old calories, and they are now being rapidly depleted. Most independent scholars agree that we either have already reached peak oil production or will do so shortly.[7] The era of cheap energy is over and, more than any other natural resource, the end of cheap energy will force us to begin redesigning our food economy as a subsystem of the ecosystem.

In the ecology of nature, species always multiply in relationship to the energy available to sustain them. When temporary energy availability causes a population of species to overproduce, that species eventually is subjected to natural processes that, once again, make it symmetrical with other species in the biotic community. Our species is likely not exempt from this law of ecology.

Of course, alternatives to fossil fuel energy are available—wind, solar, biofuels, etc. But we must face the reality that our industrial economy was created on a platform of stored, concentrated energy, which produced a very favorable energy profit ratio—the amount of energy returned on energy invested (EROI) to make it available. Alternative energy, on the other hand, is based entirely on current, dispersed energy, which has a much lower EROI. The primary sources of stored, concentrated energy are coal, oil, and natural gas. As far as anyone knows there are no other readily available sources of stored, concentrated energy available on the planet. Consequently, economies such as our industrial food system that are dependent on "cheap" energy are not likely to fare well in the future. The depletion of our fossil fuel resources not only will require that we revert to alternative fuels to produce, process, and deliver our food, it also will require that we transition to a new energy system. The truly challenging energy transition that we face is moving from an energy-input system to an energy-exchange system.[8]

A second natural resource that has fueled our industrial food system over the past century is a relatively stable climate. We often mistakenly attribute industrial agriculture's "production miracle" of the past century entirely to the development of new production technologies. In fact, our robust production was due to unusually favorable climate conditions at least as much as it was to technology. Since such stable climates are atypical, this temporary condition also represents a limited (and fleeting) natural resource.

A National Academy of Sciences (NAS) Panel on Climactic Variation reported in 1975 that "our present [stable] climate is in fact highly abnormal" and that "the earth's climates have always been changing, and the magnitude of . . . the changes can be catastrophic."[9] The report called attention to the fact that "the global patterns of food production and population that have evolved are implicitly dependent on the climate of the present century." The NAS panel then went on to suggest that climate change might be further exacerbated by "our own activities."[9] In other words, according to NAS it is this combination of "normal" climate variation plus the changes that spring from industrial economies (greenhouse gas emissions) that could have a significant impact on future agricultural productivity.

The effect that such climate change is likely to have on industrial farming systems could be especially harsh. While it is impossible to predict exactly how climate change will affect agricultural production in the near term,[10] most climatologists agree that we can anticipate greater climate fluctuations: "extremes of precipitation, both droughts and floods."[11] Such instability can be especially devastating for the highly specialized, genetically uniform, monoculture systems characteristic of industrial agriculture. For example, when 92% of cultivated land is in just two crops—corn and soybeans—as it is in Iowa, then we will need climate that is consistently favorable to those two crops to maintain productivity.

A third natural resource that will challenge the limits of our modern industrial food system is water. Lester Brown[12] points out that while we each require 4 liters of water to meet our daily liquid needs, given today's industrial agriculture, it takes 2,000 liters per day to produce each of our daily food requirements. Agriculture consumes more than 70% of our global fresh water resources for irrigation. Twice the amount of water to supply agricultural irrigation is used today as compared to the 1960s. We have been drawing down our fresh water resources at an unsustainable rate.

Such water depletion is especially troubling in China where 80% of grain production is dependent on irrigation, and in India where 60% requires irrigation. In some parts of China aquifers are dropping at the rate of 10 feet per year and in India 20 feet per year. Some farmers in China already are pumping irrigation water from 1,000 feet deep and in India from 3,000 feet.[12]

Water tables in the Ogallala Aquifer, which supplies water for one of every 5 irrigated acres in the United States, are being overdrawn at the rate of 3.1 trillion gallons per year.[13] According to some reports, this fossil water bank is now half depleted.[14]

Reduced snow packs in mountainous regions due to climate change will decrease spring runoff, a primary source of irrigation water in many parts of the world, further impairing our food production capacity. This is just one of many examples that demonstrate the close interdependence of our natural resources.

A fourth limited natural resource being depleted is soil. Soil, of course, possesses very dynamic properties and has been both accumulating and eroding for millennia.[15] Soil erosion due to human activity has for centuries been a major contributing factor to humankind's failure to maintain civilized societies.[16] However, soil erosion on US cropland overall has actually decreased by 43% between 1982 and 2003, according to the Natural Resources Conservation Service. Erosion rates have dropped from an average soil loss of 4.0 tons per acre in 1982 to 2.6 tons per acre in 2003.

Some of this improvement in soil conservation is due to the Conservation Reserve Program, which has taken millions of acres of highly erodible land out of production and seeded it to perennials. Yet 102 million acres (28% of all US cropland) are still eroding above soil loss tolerance levels.[17]

While soil loss due to erosion contributes significantly to our diminished soil quality, a more troubling aspect of soil loss is the drawdown of much of the remaining soil's "stored fertility," Howard's term for humus-rich soil.[3] Unfortunately, cheap fossil fuel energy enabled us to increase food production using artificial inputs without sustaining soil quality.[18] Having subscribed to the "NPK mentality," we ignored the law of return and now are left with soils that are essentially depleted of soil health. And as recent research has reconfirmed, soil health is not likely to be restored without the return of organic inputs in the form of cover crops, manure, and other waste materials.[19]

TOWARD A POSTINDUSTRIAL FOOD SYSTEM

So, how shall we now proceed? Can we envision and create a sustainable food system that indefinitely maintains the health of the soil; produces an adequate amount of health-promoting, affordable food; and provides us with the pleasure of good eating, in the face of depleted natural resources? I think we can, but it will require a rather radical

A Sustainable Food System

Most current efforts to define a sustainable food system assume a steady-state situation; i.e., if we just tweak our current food system so it causes less pollution, promotes conservation, regulates food safety more effectively, and includes more of the ingredients that a healthy diet requires, then it will be a sustainable. Probably nothing could be further from the truth. Since nature is full of emergent properties, sustainability is always an emerging concept. Sustainability is about maintaining something indefinitely into the foreseeable future. Consequently, to be sustainable we have to anticipate and successfully adapt to the changes ahead. Sustainability is a process, not a prescription. This process always requires social and ecological as well as economic dimensions. There is therefore no simple definition. It is a journey we embark on together, not a formula upon which we agree.

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transformation of our present food system. And given the potentially devastating impact of long-term climate change, we have a limited amount of time to implement the necessary transformations.

First and foremost, we need to transform the way we manage soil on the farm. Whether or not Howard's assertion can verify that our own health is tightly linked to humus-rich soil, it is clear that he was correct in his observation that the properties of soil were all functionally interrelated—that soil is a living, complex web of relationships that can provide enormous benefits when properly managed.

Since farmers have been indoctrinated to believe that maximizing yields by inserting a few artificial nutrients (the NPK mentality) is an all-purpose solution, and no-till is the silver bullet solution to cure all soil depletion, they are not prepared to manage soil as a web of relationships. Managing soil as a thing to be manipulated utterly fails to appreciate both the complexity and the possibility inherent in the soil profile.

While describing the nature and properties of soils could go into great detail, suffice it to say that soil is "not a thing" but "a web of relationships" always unique to its time and place.[20] Soil, as Hans Jenny described it, is "part of a much larger system that is composed of the upper part of the lithosphere, the lower part of the atmosphere, and a considerable part of the biosphere." The living organisms in the soil then become part of soil formation in relationship to all the other factors—climate, topography, parent material, time, nitrogen content, etc. In other words, life in the soil adapts to its place much as do other life forms—microbes, vegetation, animal life, and humans.[21] Therefore, soil is a dynamic, emergent property that can be managed to dramatically reduce energy consumption.

This, of course, suggests that managing soil properly is as much art as science and depends heavily on the intimate relationship that the farmer has with the soil. Considerable research has shown that soil that is managed as a complex set of relationships, including the use of green manure and livestock manure, can solve many of the production problems that the industrial farming systems attack with costly inputs. These inputs seldom address the root of the problem and require excessive energy use.[22]

Joe Lewis and his colleagues[23] clearly articulate the failure of the industrial "therapeutic intervention" strategy when it is applied to pest management and call attention to alternative opportunities inherent in ecosystem management that provide long-term sustainable solutions. They point out that while it may "seem that an optimal corrective action for an undesired entity is to apply a direct external counter force against it" the truth is that "such interventionist actions never produce sustainable desired effects. Rather, the attempted solution becomes the problem." The alternative, they suggest, is "an understanding and shoring up of the full composite of inherent plant defenses, plant mixtures, soil, natural enemies, and other components of the system. These natural 'built in' regulators are linked in a web of feedback loops and are renewable and sustainable."[23]

Approaching pest management from such an ecological perspective always involves a web of relationships. "For example, problems with soil erosion have resulted in major thrusts in use of winter cover crops and conservation tillage. Preliminary studies indicate that cover crops also serve as bridges to stabilize natural enemy/pest balances and relay these balances into the crop season."[23] In short, natural systems management can revitalize soil health, reduce weed and other pest pressures, get farmers off the pesticide treadmill, and begin the transition from an energy-intensive, industrial farming operation to a self-regulating, self-renewing one.

Other benefits flow from improved soil health. As research conducted by John Reganold and his colleagues has demonstrated, soil managed in accordance with the "law of return" develops richer topsoil, more than twice the organic matter, more biological activity, and far greater moisture absorption and holding capacity.[24] This sort of soil management acknowledges the need for greater water conservation in food production in our postindustrial world.

Such soil management serves as an example of how we can begin to move to an energy system that operates on the basis of energy exchange instead of energy input. But greater innovation is needed. Nature is a highly efficient energy manager. All of its energy comes from sunlight. Through the process of photosynthesis carbon is combined with other elements to create molecules that store energy, which is then released through the metabolism of living organisms who exchange energy through a web of relationships. Bison on the prairie obtain their energy from the grass, which absorbs energy from the soil. The bison deposit their excrement back onto the grass, which provides energy for insects and other organisms, which, in turn, convert it to energy that enriches the soil to produce more grass. These sorts of energy exchange systems could restore and renew our postindustrial farming systems, but currently very little research is devoted to exploring such energy exchanges on a farm level.

Fortunately, a few farmers have already developed such energy exchange systems and appear to be quite successful in managing their operations with very little fossil fuel input.[25] Converting more farms to this new energy model will require a major transformation. Highly specialized, energy-intensive monocultures will need to be converted to complex, highly diversified operations that function on energy exchange principles. The practicality and multiple benefits of such integrated crop-livestock have been established through research,[18] but further study will be needed to explore how to adapt this new model of farming to various thermo-climes and ecosystems.

These new farms of the future likely will be smaller than the huge monoculture operations that now dominate the landscape. The new operations will be knowledge intensive and will require an intimate understanding of the ecological neighborhoods in which various farms are located. They will need to feature management solutions based in husbandry rather than therapeutic intervention, also requiring a more intimate relationship with the farm than is typical of large-scale industrial management. But this does not necessarily mean that we have to incur higher transaction costs. Some farmers already have shown that they can manage their farms by these new principles, maintain a modest size, and aggregate their production through marketing networks featuring their own brand, thereby bringing their product into the marketplace as efficiently as do large farms.[26]

Since this new "ecosystem management" will require more farmers, we also need to adopt a new farmer culture. The notion of "freeing" people from the "drudgery" of farming so they can move to more interesting jobs in the industrial economy to improve their quality of life no longer fits our new world. This ecosystem-sensitive farming will attract a new generation of farmers who are highly skilled in ecology, husbandry, and evolutionary biology and are seeking opportunities to work closely with nature. All of this can become part of a new food culture that can actually increase the "wealth of communities" described by Bill McKibben.[27] (The notion that farming is drudgery is still deeply engrained in our culture. In his response to Wendell Berry's criticism of his glowing analysis of "Our Biotech Future" in the July 18, 2007, issue of the *New York Review of Books* [NYRB], Freeman Dyson[28] envisions a future in which we will be "liberated from the burdens of subsistence farming" and "science will soon give us a new set of tools, which may bring wealth and freedom." He does not say where the cheap energy to create and operate those technologies will come from.)

This new farming future means that we will need to invest in a new kind of training at all levels of our education system. All elementary school children should be involved in school gardens, agriculture in the classroom programs, and other learning experiences that engage them in the experience of growing food and the excitement of learning about the web of relationships and energy exchanges that can provide food for them. Such education truly would "leave no child inside." We also need to introduce more college courses in agro-ecology and provide internship opportunities for experience-based learning in ecosystems management on real farms.

Whether 40 to 50 million people will be engaged in producing food in the new postindustrial world, as Richard Heinberg suggests,[29] remains to be seen, but clearly the challenges we face will require that some of the most innovative, creative, and imaginative students available have the opportunity to become farmers.

All of this, of course, raises the specter of cost. Will food be more expensive? Using the current calculations of cost in our industrial food system, it may well be. But such calculations are deeply flawed.

We often are told that we have a "cheap food policy," which is the cornerstone of our quality of life and therefore nonnegotiable. But I would argue that we really do not have "cheap food" in our current industrial food economy. There are several flaws in the "cheap food" myth.

It is true that we spend less of our earned income on food than most other countries. But that is not a clear indicator of the cost of food. Since our earned income also is higher than most other nations, the percentage of disposable income really does not tell much about the true cost of food compared to other nations. A few years ago, Chuck Benbrook, the former director of the board on agriculture of the National Academy of Sciences, calculated the cost of food in various countries using a cost-per-calorie metric. By that calculation, 22 countries have cheaper food than we do. (This information can be obtained from Benbrook Consulting Enterprise. Chuck Benbrook, e-mail cbenbrook@organic-center. org.) But even that calculation fails to provide a true assessment of the cost of our food.

A more appropriate indicator would be the cost of food per nutrient value. This is an important indicator since many people who live in resource-poor communities only have access to food from convenience and liquor stores, as they are the few businesses that locate in these communities. These stores mostly handle highly processed food, which has very little nutrient value and is therefore very costly.

Furthermore, the price we pay for food at the supermarket counter does not include many of the external costs that are part of our industrial food system. A study by Erin Tegtmeier and Michael Duffy at Iowa State University determined, for example, that if the environmental impacts of crop and livestock production from our current industrial agriculture system were included, the additional cost per cropland hectare would be between $29.44 and $95.68 annually. Those costs add up, conservatively, to between $5.7 and $16.9 billion each year. Those are costs that affect environmental and human health and must be absorbed by the public.[30] A similar study was conducted in Great Britain that showed even higher external costs associated with industrial farming systems.[31]

An additional cheap food policy issue needs to be exposed. We in fact do not have a cheap food policy. What we have is a cheap labor and cheap raw materials policy. The industrial food system acquires its labor and raw materials as cheaply as possible so that more economic value can be added further up the food chain. This policy has created a food system in which farmers on average earn virtually no net income from their farming enterprises. As Ken Meter has pointed out, based on data provided by the Bureau of Economic Analysis, all of the cash receipts that farmers earn from farming are absorbed by their high production expenses.[32]

Since our new farming future will need to significantly increase its investment in human capital to accomplish the transformation from an industrial food system to an ecological food system, it is important to deal with this cheap labor/cheap raw materials policy. As long as this policy dominates our culture, we will always face the conundrum of having to decide between investing in farmers and thereby driving up food prices, leaving more people of limited resources without food, or squeezing farmers even more so that limited-resource people can afford to eat. Another way to solve this problem is to pay laborers a living wage so they can afford to buy nutrient-dense foods and provide farmers with the necessary resources to create the new food system that can ensure food security for all in our new world.

Finally, diversifying our farms and reducing energy inputs means we also have to change the market. Farmers cannot diversify their farming operations unless the market will buy the diverse products produced from such farms. This means that we have to diversify the food system. We will never be able to create a food system based on relationships so long as 90% of our processed food is manufactured from just 4 commodities—corn, soybeans, wheat, and rice. Nor are we likely to be motivated to change that food system as long as the government continues to provide significant subsidies to produce those same 4 crops at below cost of production. Furthermore, a food market needs to be developed that more accurately reflects the kind of self-renewing, energy exchange, plant/animal relationship that mimics nature. We can just as easily create a food market that encourages citizens to enjoy food varieties by diversifying what we produce locally as we can by importing kiwi fruit from New Zealand in January.

And, of course, our food system will need to become more localized with more community involvement. As Heinberg and others have pointed out, as energy costs go up, well-coordinated, diverse regional food systems begin to have a distinct competitive advantage over highly centralized, specialized, energy-intensive monocultures.

Fortunately, emerging trends in the market suggest that the market is ready to entertain some of these innovations. Researchers have suggested models for relocalizing the food system that seem practical and could provide numerous benefits to local communities.[33] Meanwhile, in addition to expansion in farmers markets, community-supported agriculture, and Internet sales, there is a growing demand for highly differentiated food products sought by health care institutions, school systems, restaurant chains, and other food service vendors. What most of these markets seem to be demanding is food with better taste, health, and nutrition attributes; positive food stories (good environmental stewardship, appropriate animal care, knowing where the food comes from, etc.); and a trusting relationship that preferably extends back to the farmer who produces the food.

If we can respond to these new market demands, develop public policies that put these agro-ecological initiatives on a level playing field with our current industrial food system, and devote at least 30% of the public research dollars to researching these new production and marketing models, we may be poised with a new food system that meets the challenges of the postindustrial era. It can be a food production system that is more resilient, more secure, more energy efficient, and that provides healthier food and more pleasurable eating than what the industrial food system currently offers.

Along with Richard Heinberg, I too "believe that the de-industrialization of agriculture could be carried out in a way that is not catastrophic."[29]

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