The True (Unknowable?) Cost of Industrial Food: An Economist Looks at Cheap Food

by Anita Dancs

Eggs for 79¢ a dozen? Ground beef for $1.99 a pound?

Many of us know in our gut that these prices cannot reflect the true cost of food. We know that the seemingly cheap food delivered by the industrialized global food system results in environmental degradation, exploited labor and chronic health problems. Yet, coming up with numbers to estimate the “true” cost of food is difficult, since polluted waterways and poorly treated farmworkers do not come with price tags.

Supporters of industrial food point to its benefits and argue that our living standards would be lower without it. They contend that cheap food is delivered thanks to two important economic principles. For one, economies of scale mean that bigger is better as larger farms can more efficiently utilize land, energy and other resources to grow food at a lower per bushel or per pound cost than small farms. Second, as international trade has increased, facilitated by inexpensive transportation and trade agreements, areas of the world that are relatively better at growing apples, grow apples. Places that are relatively better at growing wheat, grow wheat. Places that are better for grazing animals, raise cattle or sheep. Everyone benefits when regions take advantage of their relative endowments – the climate, type of soil, skills of workers and other attributes. As the agriculture sector has become industrialized, along with food processing industries, food is more plentiful and inexpensive, advocates claim. Moving away from industrialized food will lead to increased food insecurity, higher prices, and environmental degradation as more land and fossil fuels will be required to grow less food.

Industrial food would be a miracle if not for one detail: external costs. The prices shoppers see at the supermarket reflect private costs such as wages and the cost of land, tractors, tools, seeds and other inputs. They may also reflect government subsidies. But they do not usually reflect what economists refer to as “externalities.”

Externalities, or external costs, are unintended consequences of an economic activity that are borne by the natural environment, communities, or other third parties. Advocates for industrial food argue that the benefits outweigh these costs but a closer look at the extent of these costs and the difficulties in measuring them may make cheap food not taste so good.

External Costs Abound

Pesticide usage, including herbicides, insecticides, and fungicides, leads to one category of externalities, which includes:

- Contamination of surface and groundwater;
- Human health impacts such as neurological damage, cancer and acute and chronic pesticide poisoning;
- Loss of beneficial insects;
- Loss of biodiversity;
- Colony collapse disorder in bees;
- Current and future crop losses due to pesticide drift and the cumulative impact on soil health;
- Emergence and spread of an increased number of herbicide-resistant weeds (superweeds) and superpests.

Concentrated animal feeding operations (CAFOs) also push costs onto the environment. CAFOs force such a large number of animals to live within a small space, resulting in hundreds of millions of tons of manure. Since living in close quarters facilitates the spread of diseases, CAFO farmers administer non-therapeutic antibiotics to the animals. Some farmers also dose animals with growth hormones. Antibiotics and growth hormones contaminate the manure, making what was traditionally an agricultural resource – as fertilizer – into a significant external cost. These “manure lagoons” leak into waterways and contaminate the water supply. Antibiotic-resistance is also a consequence.

CAFOs impact the communities in which they are situated. Noxious fumes from the manure lagoons cause air pollution. Ammonia, methane, volatile organic compounds among other pollutants impact the livability of rural communities as well as the health of the residents. Journalist David Kirby in his book Animal Factory follows rural communities where farms have transitioned from traditional livestock and dairy operations into CAFOs. While these stories are anecdotal, it is hard to deny the external costs borne by these communities as noxious fumes infiltrate homes in Yakima Valley, Washington, industrial dairies contaminate waterways in Illinois, and recreational activities such as fishing and swimming are destroyed by intensive hog farming on the Neuse River in North Carolina.

Inexpensive food may be undervalued by consumers, leading to waste. Each year, 14 million tons of food are thrown out each year, which is 106 pounds per person, according to the Environmental Protection Agency. Little of it is composted; almost all of it is incinerated or landfilled. While wasting food may feel immoral in a world where millions go hungry, it also has external costs. Landfills and incinerators produce greenhouse gases, particularly methane, which is twenty times as harmful to the atmosphere as carbon dioxide.

Greenhouse gas emissions released throughout the stages of industrial food production from petrochemical fertilizers through manure lagoons to waste, cause climate change. An oft-cited study published in the Annual Review of Environment and Resources found that food systems may account for as much as 29% of total anthropogenic greenhouse gas emissions, with the vast majority arising from agriculture production or land-use changes such as deforestation for crop production.

The industrialized food system has also facilitated dietary changes that have substantial costs to our well-being and the health care system. These dietary shifts have led to increases in various illnesses such as Type II Diabetes, hypertension, cardiovascular disease and osteoporosis. Food allergies and a number of chronic conditions are possibly linked to changes in our diet as well. (continued on page B-3)

Inside this Supplement

The External Costs of Food B- 2
The Affordability of Organic Food B- 7
The Untold Cost of CAFOs B-11
The Real Cost of Real Food B-15
Prices: Organic & Conventional B-20

Published by the Northeast Organic Farming Association, (NOFA), www.nofa.org, 411 Sheldon Rd., Barre, MA 01005, 978-355-2853, tnf@nofa.org
The External Costs of Food

by Jack Kittredge

Most people, when asked the cost of something, would answer with a monetary figure based on how much money it would take to buy that thing.

Well, that won’t do for economists, and it won’t do for us in this issue of The Natural Farmer. From an economist’s perspective, that is simply its market price. The true cost may be far less or far more than the market price. The difference, costs not included in the market price, are called external costs, or “externalities.” An externality is “a cost or benefit not transmitted through prices that is incurred by a party who did not agree to the action causing the cost or benefit.” General types of externalities associated with food include ecological effects, environmental quality, greenhouse gas (GHG) emissions, animal welfare, social costs associated with labor, and public health effects.

To take an extreme example of food with a high external cost, consider wheat produced in Oklahoma during the drought of the mid-1930s. Settlers a generation before had plowed up the prairie, exposing the rich, 6-foot deep topsoils. During a few years of rain and relatively high wheat prices during World War I this cropping strategy was handsomely rewarded. But the war ended, wheat prices fell, the topsoil carbon was oxidized into carbon dioxide, and when drought returned the soil dried into dust and blew away, darkening the skies as far away as Chicago and New York. What little wheat was able to be grown in Oklahoma during the Dust Bowl had a low market price. But it had a huge external cost. The federal government had to come in and buy up millions of acres of marginal prairie to keep it out of production and artificially subsidize the remaining farmers so they would convert their fields back into prairie. The cost of that wheat was far higher than its price and the American people, who had no hand in planting wheat in the prairie, picked up that cost as an externality.

It may seem pretty daunting to try to estimate the various external costs or benefits of any economic operation. It is. But without including those externalities, how can we accurately evaluate decisions or make public policy?

How about an externality where we are looking at benefits? What is a good example of that?

Try going from a conventional chemical farming operation to a low-input or organic one. The farmer may adopt changes such as a more complex rotation to get ahead of weeds, pests, or disease, less tillage to preserve biodiversity and soil carbon, less synthetic fertilizer and more dependence on minerals broken down by soil biology, and less poisons – again to preserve soil life and allow them to be harnessed to enhance plant health.

Those changed agricultural practices have consequences. Less soil is eroded because of lessened tillage and as a result less phosphorus runs off in surface water. Reduced tillage and fertilizer use resulted in reduced nitrogen loss as both nitrates and nitrous oxide, leading to lower greenhouse gas emissions. And cutting pesticide use results in less polluted air, water and soil. What are the ultimate consequences of reducing inputs? Off-farm you get better flooding control and drainage from less erosion, cleaner water from less pollutants, mitigated global warming because of reduced greenhouse gases, cleaner and safer air from the use of fewer emissions and toxins.

These externalities benefit all of society (all living organisms, really) not just the people who made the farming management changes.

Economists have developed ways of putting dollar figures on these external costs or benefits. These methods are better covered in a graduate course on economics than here. But, basically, they flow from the costs of repairing damages resulting from the initial activity. Or, in the case of benefits, counting costs not incurred (and thus saved) because damage was prevented.

The Food and Agriculture Organization (FAO) of the United Nations has developed these “full cost accounting” (FCA) methods to look at the disturbing reality that one third of all food produced in the world is wasted. This is either because of its failure to reach the market, or, especially in developed countries, because it is discarded unconsumed after purchase.

On the next page is a table suggesting how the FAO evaluates various kinds of impacts from an activity and gives them an external cost in dollars and cents. To arrive at those values, researchers try to measure the values people place on different outcomes. They try to take into account variables such as income and purchasing power, cultural values, traditions, etc. Their estimates usually result in a range of value because for particular outcomes different peoples and countries will have a different willingness to pay or avoid them.

The numbers the FAO assigns to the dollar costs of externalities involving food waste are surprisingly large!

If you are still with me, you now understand how these costs can be given dollar values. So you may as well stay along for the rest of the ride. How much does wasting a third of the world’s food really cost? Turns out, once you factor in the impact of this waste on the atmosphere, water, soil, and social costs as well as the economic ones, the cost is pretty high. For wasted food with a market price of $936 billion dollars, the FAO says the true cost is $2.6 trillion. If you applied that ratio to a household in the US, for every $100 of food you waste by letting it sit in the fridge and go bad, you are also costing someone to pay another $180 of external costs needlessly.

Now we have another, slightly more current argument than the long suffering starving Armenians for why thoughtful children should finish their meals!
food consumption such as the presence of genetically-modified ingredients in food.

The true cost of food is also reflected in the people who grow crops and slaughter animals. In the U.S., about half of farmworkers are undocumented, according to an analysis of Department of Labor data done by the organization Farmworkers Justice. Given the reluctance of undocumented workers to participate in surveys, or to respond accurately, this is probably a significant underestimate. Undocumented workers, fearing deportation or worse, will tend to be unwilling to report abuse, workplace injuries, underpayment of wages, or other contract violations. A year-long investigation of female farmworkers by PBS’s documentary series, Frontline, documents not only the abuse they suffer from repeated rapes, but their fear in reporting the abuse. Even farmworkers with an H2-A visa are tied to their employer and are much more vulnerable than the average employee.

Small farmers might be said to exploit themselves. Power in the food system has led to lower farmgate prices making it more difficult to make a living at farming. The average small farm, according to the USDA, has negative farm earnings and is reliant on outside income. Many small farms commonly use outside income to invest in the farm to keep it going. Even small farms with moderate sales earn nearly half their income off-farm.

Measuring External Costs

The low price of food at the supermarket is only the illusion of efficiency, given these externalities. But is it possible to assign dollar values to the array of costs? Several studies have tried to do just this. For example, a Dutch study estimated the “true” cost of pork. It found that conventional pork would need to be priced nearly one-third higher than it is currently sold in supermarkets in order to reflect all private and external costs. Cornell scientist, Dr. David Pimentel, concluded that pesticides cause $10 billion annually in environmental and societal damages in the U.S., including $2 billion alone in groundwater contamination.

Other studies have attempted to be even more comprehensive. In 2000, Jules Pretty and a number of other scholars attempted to measure the externalities arising from agriculture in the UK. They grouped external costs into seven categories, the first four of which concern damage to natural capital: (1) water (e.g. pesticides in drinking water); (2) air (e.g. nitrous oxide emissions); (3) soil (e.g. organic matter losses); (4) biodiversity and landscape (e.g. hedgerow and bee colony losses). The other three categories concern damage to human health arising from: (5) pesticides (acute and chronic effects), (6) nitrates and (7) microorganisms and other disease agents (e.g. antibiotic resistance). For 1996, the authors estimate that there were around $3.7 billion (approximately $5.6 billion in today’s dollars) in external costs, or $325 per hectare (nearly $500 in today’s dollars of arable land or permanent pasture.

Guided by the framework of the UK study, Erin Tegtmeier and Michael Duffy, economists at Iowa State University, published a similar study on U.S. agriculture. Their findings had a lower per hectare amount due to the exclusion of costs such as bovine spongiform encephalopathy (BSE) and agency monitoring costs that were present in the UK study. They concluded that in 2002, somewhere between $5 and $15 billion ($6.6 to $19.7 billion in today’s dollars) were the external costs of agricultural production. U.S. agriculture accounts for about $192 billion of the annual GDP, so external costs could be as little as 3.5% of total output at the low end, or as much as 10% at the high end.

Given the long list of external costs, these numbers may seem surprisingly low. Though these studies...
may be thorough and systematic, difficulties arise in estimating costs as the authors of such studies are the first to acknowledge. For one, some of the estimates are known to be substantial underestimates, such as treating eutrophication of reservoirs and restoration of hedgerows in the British study. Moreover, external costs that are deemed impossible to calculate such as treatment of marine eutrophication and flood defenses are excluded. The data available only enable partial estimates in some cases. For example, records used to determine the impact of feedlot spills on fish kills were only available for ten states in the U.S. study. The British study did not have data on treatment of drinking water costs for the entire country so the estimate to rid drinking water of pesticides and other contaminants was incomplete.

Uncertainty also plays a role in limiting the accuracy of external cost estimates. The human and ecological costs associated with climate change provide a ready example. While scientists agree that the costs of climate change will be large, identifying exactly what form they will take and when is still deeply uncertain. Even if we knew precisely how any weather patterns would shift and the problems associated with them, putting dollar values on more frequent flooding from hurricanes or inability to grow food is complex. All this makes deciding how to put a price on carbon emissions very difficult. Is the social cost of a ton of carbon $37, as the White House says, or $900, as economist Frank Ackerman poses as a high-end estimate? Or is it $0, the implicit price, given the lack of regulation, and the price that might be posited by climate deniers? In the study on the external costs of U.S. agriculture, the authors assume a price of $0.98 per ton of carbon for a total of $451 million. If they had used the White House price for carbon, the climate change cost alone would be $17 billion doubling their entire estimate for the external costs of agriculture. A price of $900 per ton would result in $414 billion. In other words, the costs of industrial agriculture would clearly outweigh the benefits, assuming the benefits are mostly reflected in market prices.

The impact of other events is even less known than climate change. For example, the impact of pesticides as endocrine disruptors is unknown. The impact of the spread of genetically-modified seeds is unknown both in terms of human health and genetic pollution. What could be the impact of colony collapse disorder of bees? In the British study, bee colony losses are estimated at a few million dollars and in the U.S. study at $410 million. A study out of the UC-Berkeley found that pollinators impacted 35 percent of the world’s crop production. Like climate change, bee colony collapse could be catastrophic.

Putting a price tag on nature itself is fraught with challenges. Scholars in Ecological Economics estimated that ecosystems globally provide on average $33 trillion annually worth of services (or nearly $50 trillion in today’s dollars). In other words, ecosystem services are worth at least two-thirds of all the human-made goods and services produced annually in the global economy. Even if this type of estimate were solid, how a loss or partial loss of an ecosystem or biome will reverberate through the economy is difficult to project.

Many studies of costs simply have yet to be done or are rough approximations rather than detailed estimates. A European Union report asserts that a definitive study on the economic burden of nutrition-related health disorders is still needed and that available data on health care indicates that the cost is billions and billions of dollars.

Another source of underestimation occurs because many of the victims of external costs have no power. Undocumented farmworkers’ stories of working in U.S. fields and slaughterhouses are not fully known because of their vulnerability. Farmers in developing countries have little power in the marketplace when faced by the behemoths of the food industry that control many of the inputs to production as well as the markets for produce and meat. Contracted chicken growers in the U.S. are unwittingly replicating the sharecropping relationship between former slaves and plantation owners during the nineteenth and early twentieth centuries.

The State Agriculture Councils of the United States seek to ensure that animal production systems are humane to animals and sensitive to the environment. To learn more, visit humanesociety.org/agcouncils.
likewise, animals have no power in the economy. how should we value animal welfare?

This doesn’t mean we shouldn’t attempt to identify these costs and even try to put a dollar value on them. given the politicized nature of civic decision-making, and the low-power positions of those suffering from the current food system, making the costs known and even offering numbers might be seen as a sort of affirmative action plan for a better food system. yet we should acknowledge that political difference may be based on values and no numbers will ever convince a supporter of the industrialized food system that we need change.

Moving toward more sustainable food

Given the numbers we do know and given the level of risk involved in continuing our current food system, the case can be made for moving toward greater sustainability. A more sustainable food system would need to produce abundant, healthy food, grown and processed by those who earn a living wage, and which would minimize the environmental impact such that the level of future generations’ well-being would be at least that of our own.

What is less clear is how we get from today’s food system to a more sustainable one. we often hear that consumers can make a difference by voting with their dollars. many economists, though, would argue that relying too heavily on consumer choice will take too long. climate change, increased competition over scarce resources, continued worker exploitation, animals unable to stand up on their own legs, contaminated water supplies, increased chronic health conditions, biodiversity loss, superweeds, and destroyed recreational areas will be the result.

Economists’ most typical solution to external costs of any economic activity is called a “Pigouvian” or corrective tax. if we can measure the externalities – for example, how much it would cost to clean up a polluted water supply – we can assess a tax on the activity causing the pollution that will provide the funding for the clean up. the tax will also serve to make a polluting method of production relatively more expensive, and cleaner methods of production relatively less expensive, changing incentives toward better behavior. this incentive-based mechanism underlines the importance of continued research on external costs of the food system.

“Pigouvian” subsidies can also play a role in subsidizing research and production methods that lead to positive spillover effects such as increased soil health or new information on organic pest management.

Governments, universities, and independent foundations can support research and development of alternative agriculture and identify pathways for scaling up successful experiments in no-till agriculture, permaculture, managed grazing or other promising avenues. these institutions may be implicated in the development of our current food system, but this only indicates the power that can be harnessed for positive change.

Regulations can also play a role by eliminating pesticides that are linked to chronic illnesses or disorders like colony collapse.

Colonies collapse disorder. what is the value of the world’s bees?

though recent defeats of labeling laws in California and elsewhere sound a pessimistic note, food labeling laws combined with accurate information can help consumers make better choices.

Our global food system didn’t simply evolve. there is nothing predetermined about the system we have. research went into developing, for example, new active ingredient pesticides and genetically modified organisms. many of the choices made reflect power in the food system and the role of the profit motive. a more sustainable food system can only be brought about by countering the power in the current food system. organizations like nofa are already an active part of the alternative food movement, educating consumers and connecting them to producers while lobbying for more productive government policy. these activities must continue and grow.

For those interested in reading more, the author recommends the real cost of cheap food by michael carolan, published by earthscan. antis dancs is a nofa/massachusetts member and a professor of economics at western new england university.

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ANDRÉ LEU

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The Real Story on the Affordability of Organic Food

by Stephanie Davio, Chris Ryan and Jay Feldman

It is often said that organically produced food has higher prices at the store because it takes more time and energy to produce than its chemical-intensive counterpart. Compared to so-called conventional chemical-intensive farming, organic farmers pay closer attention to the health of their agricultural ecosystems and the potential results of their farming practices for both humans and the natural world, and this more intensive management does come with a price tag.

However, this is only part of the story, as it overlooks the glaring fact that conventional farm operations do not incur the total cost of their production. Chemical-intensive agriculture has countless negative effects on our health and natural resources, which are not accounted for in most traditional farm business models, but are passed on to society nevertheless. We still pay these costs, just not at the grocery checkout counter. Instead, we see these costs in the form of higher taxes and medical bills, and decreased quality of life due to environmental pollution. Conversely, organic farmers take steps to ensure that they do not create these effects, which result in external costs. Instead, they internalize them and take care not to damage and deplete natural resources or create public health problems. The question, then, should not be, “Can we afford to buy organic food?” but rather, “Can we afford not to?”

The following data suggest that we are going to go broke cleaning up after conventional agriculture.

Who Eats Organic?

The chemical-intensive agriculture and food industry likes to characterize organic as elitist. In reality, this is far from the truth.

An analysis published in Choices Magazine finds that households with income levels of less than $25,000/year actually spend about the same or slightly more on organic than higher income groups. The magazine concludes, “Contrary to popular opinion, we do not find any consistent positive association between household income and expenditures on organic produce.”

Another poll conducted by Thomson Reuters and National Public Radio (NPR) shows that a majority of Americans prefer to buy organic food when they have the chance. The survey asked five questions of respondents:

1. Given a choice, would you prefer to eat organic or non-organic foods?
2. What are your reasons for preferring organic food?
3. What are your reasons for preferring non-organic food?
4. Given a choice, where would you most prefer to get your food?
5. In a restaurant, would your ordering decision be influenced by the availability of organic options?

The results find that 58% of respondents say they choose organic over conventionally produced foods when they have the opportunity; this number spikes higher among both young and highly educated respondents. Those who most prefer organic food include respondents under the age of 35 and 60% of those earning more than $100k per year expressing a preference for the taste of organic strawberries, as well.


cost patients $1.2 billion dollars annually. This was also as a result of hospital and medical bills and lost work, as well as treatment of pesticide-induced cancers and even fatalities.

Food Contamination

Environmental illness can result in serious hardship on every level, from physical to psychological. It also burdens us, both personally and as a society, with seemingly insurmountable economic costs. Childhood illnesses are particularly susceptible to chemical exposure in the environment and studies have shown significant financial costs associated with protecting children from hazards and treating chemical-induced diseases. A 2008 study of 1,000 children in Michigan spent $5.85 billion coping with just four environment related childhood diseases –lead poisoning, asthma, pediatric cancer, and neuro-developmental disorders.

Of course, not all environmental illnesses result from chemical intensive agricultural production. However, with nearly one billion pounds of pesticides used in agriculture, one can only doubt a significant contributor to exposure, poisoning, and the onset of chronic illnesses. Pesticide-related medical care bills are also astronomical, costing to cost patients $1.2 billion dollars annually. This is far from the truth.

Not only does organic farming eliminate the need to use dangerous pesticides, chemicals, it represents the opportunity, through more humane management systems, to reduce the danger and prevalence of microbial pathogens in the food system. According to a report from the University of Florida’s Emerging Pathogens Institute, salmonella is the leading disease-causing pathogen found in foods through out the country. Compiling data from the costs of doctor’s visits, hospitalization, prescriptions, lost wages, and estimated economic value of a premature death, the researchers found that total salmonella contamination resulted in a financial burden to society of $3.3 billion.

Pesticides and Disease

Pesticides are one of the most dangerous and toxic parts of our food system. For more information on the health impacts of these chemicals, the Pesticide-Induced Diseases Database, managed by Beyond Pesticides, facilitates access to epidemiologic and laboratory studies based on real world exposure scenarios that link public health effects to pesticides. The scientific literature documents elevated rates of chronic diseases among people exposed to pesticides, with increasing numbers of studies associated with both specific illnesses and a range of disabilities. With some of these diseases as serious as high and, perhaps, epidemic proportions, there is an urgent need for public policy at all levels –local, state, and national – to end dependency on toxic pesticides, replacing them with carefully designed green strategies in order to save lives and bring down our medical costs. Visit www.beyondpesticides.org/health to examine the data.

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“Conventional?”

We have come to differentiate organic from chemical-intensive agricultural practices by referring to the latter as “conventional.” Of course, it is conventional only in the sense that it is the most commonly practiced form of agriculture in the U.S. From an ecological and environmental health perspective, however, it must be said that these chemical-intensive practices defy conventions of what we know to be healthful practices that support soil biology, biodiversity, plant health, and protection of human health and the environment.
The study also examines the prevalence of salmonella that is resistant to antibiotic treatment and compares the results across organic and conventional. The results show that resistance to the antibiotic streptomycin is 36.2% at conventional farms, compared to 25% at organic. Perhaps even more significant, multidrug resistance to six different antibiotic treatments (ampicillin, streptomycin, amoxicillin, cephalothin, cefotaxim, cefoxitin) is at 39.7% on the conventional farms, whereas none of the organic birds show resistance to this combined treatment. Antibiotic and antimicrobial resistance is a serious public health issue, since it can lead to infections that are expensive and difficult to treat.

**Feeding the World... Safely**

Although it is often said by advocates of industrial farming that organic farming will never produce equal amounts of food as conventional systems. A 2006 study performed by researchers at the University of Michigan found that global yields of organic compared with conventional systems are equal on average. In the developing world, organic yields are even higher. The team also estimated that “organic methods could produce enough food on a global per capita basis to sustain the current human population, and potentially an even larger population, without increasing the agricultural land base.” (Badgley et al. 2007)

Perhaps most significantly, a report issued at the end of 2010 by the United Nations Special Rapporteur on the Right to Food came to the conclusion that widespread adoption of “agroecological” food production systems, such as organic, would be the best way to effectively feed the growing global population. (UN General Assembly 2010) These kinds of systems, the report finds, actually have the capacity to double current levels of food production in areas of the developing world.

Despite claims by proponents of industrial agriculture, conventional approaches are not adequately feeding the current global population, making it hard to anticipate that they would do so in the future. As was noted by the International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD), “Although global production of food calories is sufficient to feed the world’s population, millions die or are debilitating every year by hunger and malnutrition...” (McIntyre et al. 2009) It is, of course, possible that as the population increases food production will have to increase as well, but without reform to global food distribution systems, that will persist, no matter the production methods employed. Here again, organic systems provide a path forward. Due to the reduced need for inputs and lower startup costs, it is much easier for small or smaller scale farmers around the world to start a farm using organic methods. Since small scale farms tend to have more localized distribution networks, they can support rural or isolated communities in areas that globalized markets cannot reach.

**Farmworker Safety**

Farm work is one of the most dangerous jobs in the country, due to harsh working conditions, heavy machinery, and exposure to hazardous substances. To help explain the urgent need for a major shift to organic food production and consumption, Beyond Pesticides launched the Eating with a Conscience database, which evaluates the impacts on the environment and farmworkers of the toxic chemicals allowed for use on major food crops grown domestically and internationally. Certain foods are often identified in the media as being “clean” due to a lack of pesticide residues. While it is helpful to alert consumers to hazardous residues on food, food residues are only part of the story. It turns out that those very same “clean” food commodities may be grown with hazardous pesticides that get into waterways and groundwater, contaminate nearby communities, poison farmworkers, and kill wildlife, while not all showing up at detectable levels on our food.

Farmworkers are at particular high risk by the use of toxic substances. While taking hazardous pesticides out of food production reduces hazards on the farm, farmworkers often face a lot of hardships that are not addressed by this guide. Farmworkers have long fought for better working conditions, wages and labor practices. To learn more about how our food choices affect workers and the environment, visit www.EatingWithAConscience.org.

**Federal Agricultural Subsidies**

Most of our federal agricultural subsidies are provided to only a few commodity crops—corn, cotton, wheat, rice, and soybeans—with most of the money going to large-scale, corporate farms. In the 2008 Farm Bill alone, the amount of funding for commodity crop programs was estimated at $41.6 billion by the Congressional Budget Office. This amount dwarfs the $402 million for organic agriculture. U.S. agricultural policy encourages massive monopolies that provide the perfect breeding grounds for pests and disease and require heavy inputs of toxic pesticides and synthetic fertilizers to maintain and preserve productivity. There are very few federal incentives for farmers to adopt organic practices, such as crop rotation, soil building, and erosion control. Several fledging programs do offer support for organic farmers and enhance their ability to provide us with a safe and sustainable food supply, but they are often neglected in federal budgets as they struggle to make a difference. Until these policies are reformed, it is going to remain difficult for the vast majority of Americans to have easy access to food that is produced in ways that do not pollute their environment or put their health at risk.
The creation of healthy soil makes synthetic fertilizers unnecessary, and higher organic matter in the soil makes it better able to absorb nutrients and water, reducing erosion and runoff. Water usage is also lessened, as research has shown that organic soils retain as much as 20% more water than conventional soils. Although this kind of diligent management may seem at first to be more resource intensive, the conventional model lead only to a cycle of chemical dependence. With little to no soil organic matter to hold onto the nutrients, these fertilizers then leach into ground water or erode into waterways along with the soil, damaging natural ecosystems and leading to algae blooms and dead zones.

Organic farmers, by contrast, take great care to create rich, fertile soil full of essential plant nutrients, so that crops growing on the land will have a steady supply of fertility. The organic farmer’s motto is “feed the soil to feed the plant.” The Organic Foods Production Act (OFPA), which establishes production standards for food certified and labeled “USDA Organic,” identifies soil health as a central principle. OFPA requires the development of an organic system plan for every farm that, under the law, is required to “foster soil fertility, primarily through the management of the organic content of the soil through proper tillage, crop rotation, and manuring.” The creation of healthy soil makes synthetic fertilizers unnecessary, and higher organic matter in the soil makes it better able to absorb nutrients and water, reducing erosion and runoff. Water usage is also lessened, as research has shown that organic soils retain as much as 20% more water than conventional soils. Although this kind of diligent management may seem at first to be more resource intensive, the aim is to create a more self-sustaining and resilient system and reduce overall inputs, while preserving and nurturing the natural resources. In the long run, this does save money. A team of university researchers studying agricultural activities in Oregon’s Willamette Valley found that when all of the off-site costs of soil erosion are taken into account, such as keeping navigation channels clear and treating municipal water supplies, the total cost amounts to as much as $5.5 million annually—not accounted for in the price of food produced on eroded land.

Biodiversity

Another natural resource which is essential for the production of food but has been drastically under-valued and overlooked is biodiversity, especially as it relates to pollinators and beneficial wildlife. According to rural sociologist Doug Constance, PhD of Sam Houston State University, in order for a system to be sustainable, it must be resilient and able to adapt to change. Resilience, in turn, depends in large part on the diversity of the system and the ways in which it can respond to challenges. This is especially true of biological systems, such as agriculture. Diversity is essential for the system to survive—diversity of crops to reduce pests and disease, as well as wild plant species to foster populations of beneficial insects, like pollinators and pest predators. Each of these pieces plays a key part in supporting natural systems and makes possible the growth of healthy plants and food. The estimated economic costs of losses to biodiversity in the form of pollinator services, beneficial predators, birds, and aquatic life amount to more than $1.1 billion every year.

Pollution

Pollution is, of course, one of the most significant and easily recognizable effects of the environmental degradation caused by conventional agriculture, and pesticides are one of the chief sources. The total cost of pollution and remediation from the contamination of the natural environment by pesticide chemicals is valued at $1.3 billion annually. Iowa State University scientists estimate that, with an average of approximately 447 million kilograms of pesticide active ingredients applied in a year, external costs amount to about $2.55 for every kilogram of active ingredient applied. This does not include medical costs or as a result of health problems to pollinators, as cited above. The financial impact is broken down
Cornell researcher David Pimentel, PhD estimates the external costs of pesticides to be much higher, at almost $10 billion a year. The costs of environmen- tal contamination and resulting damages account for $8.5 billion alone, with the remaining costs going to public health impacts. Dr. Pimentel’s team breaks down the environmental costs into the categories of animal deaths and poisonings, loss of natural pest enemies, pests evolving pesticide resistance, honey bee and pollination losses, crop losses, fishery losses, bird losses, groundwater contamination, and government regulations to prevent damage.

Pollution also comes from sources such as nitrates from fertilizers and manure from industrial livestock operations. Excess nitrogen in waterways often results in algal blooms as the organisms feed on the increased supply of nutrients. Large algae popula- tions, however, require large amounts of oxygen to sustain themselves and algae blooms tend to deplete much or all of the dissolved oxygen from an aquatic environment, killing most other aquatic life in the area. The estimated costs of water treat- ment to remove nitrates and wildlife losses due to manure runoff from intensive livestock operations amount to over $200 million annually.

A large scale evaluation was recently completed in Europe that attempts to analyze the costs to society of nitrate pollution. Of course, not all nitrogen is for agricultural fertilizers. Evaluating the various effects that excess nitrogen has on water, air, and soil quality, as well as atmospheric balance, biodiversity, and natural ecosystems, the team found that excess nitrogen in the environment results in costs as high as $460 billion a year for the European continent. Research has shown that organic systems can retain significantly higher percentages of nitrogen in the soil. A year after fertilizer applications, organic soil retained 47% of the nitrogen, while conventional soil retained only 17%.

Climate Change

Most economic studies fail to account for agricul- ture’s contribution to global climate change. Since we are just now beginning to see the effects of this phenomenon, it is difficult to tag them with a dollar value. However, it is abundantly clear that industrial agriculture contributes great amounts of greenhouse gases to the atmosphere while paying for none of the consequences that will result. It is left to con- sumers to handle and mitigate these consequences.

Industrial producers who emit thousands of tons of carbon dioxide and methane into the atmosphere pay none of the costs of an increasingly volatile global climate, causing unpredictable weather patterns and exacerbating the scarcity of natural resources. According to the latest report from the Intergov- ernmental Panel on Climate Change (IPCC), world agriculture contributes as much as 12% of global greenhouse gas emissions. This figure does not include secondary effects of agriculture, such as the fossil fuel intensive production of synthetic pesticides and You, vol. 31, no. 3, 2011, published by Beyond Pesticides, http://www.beyondpesticides.org

Organic agriculture, however, has proven to be a powerful response to this problem. Not only do or- ganic practices emit much fewer greenhouse gasses, they actually present the potential to sequester sig- nificant amounts of carbon in the soil. According to the Rodale Institute’s Farming Systems Trial, which began in 1981, an organic system of corn produc- tion requires 30% less energy on average to produce yields comparable to a conventional system. The savings are accounted for not only in direct produc- tion practices such as reduced machinery use, but also in the fact that production of synthetic nitrogen fertilizers for conventional systems requires sig- nificant amounts of fossil fuels. Organic systems, by contrast, get their nitrogen from natural sources such as nitrogen fixing plant species, cover crops, compost, and manures.

Organic practices not only present the potential for minimizing the problem, they can also contribute to an active solution. According to the International Federation of Organic Agriculture Movements (IFOAM), organic farming could potentially se- quester up to 32% of man-made greenhouse gases in the soil. The Rodale Farming Systems Trial shows that organic systems can sequester 2.3 tons of atmospheric carbon in the soil per hectare per year. Through reduced tillage, incorporation of plant resi- dues, and fostering a diverse population of soil life, the soil and plants can become carbon storage sinks, instead of releasing the gasses into the atmosphere.

External Costs Conclusion

External factors and costs add up. Farming opera- tions do not have to account for them, so they do not pass on the costs through the price of food. But make no mistake, the costs are passed on to the consumer as a taxpayer. We are paying for the costs of health impacts, farmland erosion, pollution cleanup, water treatment, climate adaptation, and so much more through our public funded institutions. Organic farmers, in putting these costs up front, rather than passing them on in secret, actually save us money in the long run. A key to addressing our nation’s urgent health and environmental problems is the shift to organic production. Although it is tempting to continue buying conventional food with deceptively cheap prices, we just can’t afford it.

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Although the reduction of harm caused by CAFOs is desirable, EQIP payments raise legitimate questions about whether the public should underwrite CAFOs in this way. This is especially important when considered in the context of alternative production systems that are efficient, cause fewer problems, and have greater societal benefits.

Subsidies are appropriate buffers for the agricultural sector against the uncertainties of nature and price dips due to overproduction, and they encourage conservation and technological innovation. It is essential, however, that subsidies also encourage and support desirable agricultural practices.

How Crop Subsidies Have Propped Up CAFOs

Livestock raised in confinement eat an enormous amount of corn and soybeans. Grain and animal production (and their respective costs) are therefore inseparable when evaluating CAFO production. Over the last 80 years or so, U.S. farm policy has subsidized the production of commodity crops such as corn and soybeans in a variety of ways; currently, some payments are made to commodity farmers regardless of market prices or production costs. Here we examine whether these subsidies have contributed to the growth of CAFOs, which are the primary users of these crops.

A majority of the two most widely cultivated crops in the United States, corn and soybeans, is fed to livestock. In 2007, corn was grown on about 93 million acres and soybeans on about 64 million acres. Alfalfa is grown for livestock forage on about 22 million acres (out of the 60 million total acres devoted to various types of hay); sorghum (mostly for feed) is grown on about 8 million acres and substantial amounts of corn stover (stalks and leaves) are also used for cattle forage or silage.

By contrast, wheat (the crop most widely grown primarily for food in the United States) is planted on about 60 million acres, and rice on less than 3 million acres. Most familiar vegetable and fruit crops are grown on even smaller acreages. For example, potatoes are grown on about 1.1 million acres, tomatoes on about 425,000 acres, apples on about 360,000 acres, lettuce on about 310,000 acres, and carrots on about 100,000 acres.

The tremendous amount of corn and soybeans grown for animal feed reflects the huge amount of animal production in the United States. Feed grain costs make up a large proportion of the cost of raising animals in CAFOs: corn and soybeans generally make up about 50 to 60 percent of the cost of producing chickens, eggs, and pork, and somewhat less for dairy and beef. Because cows can efficiently digest the cellulose that comprises most of a plant’s stalks and leaves, cattle could survive on those parts of crops rather than on kernels or beans. However, in CAFOs a cow’s diet is largely composed of grain, which has high caloric or protein content, can be easily transported to the animals compared with bulkier forages, and is relatively cheap.

Because of the close connection between crop prices and CAFO costs, it is important to understand the forces that determine grain prices in the United States. Federal government policy, for one, has a significant effect on the price of corn, soybeans, and a few other crops. The government has implemented various programs under Title I of the farm bill to buffer farmers against loss (such as losses resulting from farmers’ tendency to overproduce commodity crops, leading to crop prices that are often below the cost of production). Farmers also tend to accept lower market prices because they are not as economically concentrated as farm input industries or food processors and retailers, and their commodities are perishable.

Indirect Subsidies across Sectors

In summary, commodity crop subsidies that compensate for low grain prices contributed about $34.74 billion between 1997 and 2005 to poultry, swine, beef, and dairy CAFOs. This amounts to about $3.86 billion per year, with the proviso that data for dairy cows and beef cattle are limited by region and year, and therefore nationwide averages over time are provided for illustration purposes.
rather than as highly accurate values for these sectors. The data from the preceding analyses are summarized in the following table.

Because of integration in the animal products industry, these savings are a boon to processors as well as CAFOs. For example, the four largest broiler companies saved approximately $5.6 billion from 1997 to 2005, and the four largest swine processors saved about $4.3 billion.

Subsidies for Alternative Production Methods

It is useful to ask whether alternative methods of producing livestock have also benefited from crop subsidies. Have these subsidies favored CAFOs over other means of producing livestock that have fewer externalities? Diversified farms—those that produce both grain and livestock—are one alternative to specialized CAFOs, which grow little or no grain.

CAFOs have much less cropland available, relative to the amount of animals, compared with smaller operations. Medium-sized operations of 150 to 300 AU (animal units—an animal unit equals one cow or 2.5 pigs) had 1.7 AU per acre—or 10 times less land per animal. Smaller and medium-sized diversified farms would generally be expected to use all of the manure produced by their animals in an economically and environmentally favorable manner (provided their cropland is near the livestock operation).

Changes in the 1990 farm bill allowed farmers to retain the grain they produce but still receive loan deficiency payments. Therefore, diversified farms could benefit from Title I subsidies even if they retained their grain as feed for their own animals rather than opting to sell it. However, grain subsidies do not necessarily entirely compensate for low grain prices. One study found that, over a two-year period, Title I subsides usually did not fully compensate farmers for the difference between production costs and grain prices. Even though diversified farms could benefit from crop subsidies, they would not receive as great a benefit as CAFOs that purchase grain.

To illustrate the subsidy gap, our calculations show the lower feed cost for CAFOs compared with hog farmers who grew their own grain in 2000 and 2001 (see below table). Title I subsidies would therefore have favored the development of CAFOs over diversified farms. It should also be noted that even with subsidies for diversified farms that grow their own grain, such farms may generally have produced this grain at a loss.

Indirect subsidies for pasture systems

To the extent that alternative means of livestock production and non-grain forages are not subsidized benefit from crop subsidies. In particular, pasture production and non-grain forages are not subsidized and are therefore put at a disadvantage by these non-market practices.

Many alternative production methods can be as profitable as CAFOs (or more so), but tend to be somewhat less efficient in terms of feed conversion. In other words, more feed is often needed to produce a unit of product (meat, milk, or eggs) compared with CAFOs. But these analyses do not take the costs of externalities into account. Doing so is a complicated task; what follows merely scratches the surface.

First, alternatives are often less reliant on grain production—itself a system of questionable sustainability under prevalent farming practices. Although this topic is beyond the scope of this report, grain production is a major contributor not only to soil degradation, but also to the pollution of aquatic ecosystems that are important sources of food. Less than half of the synthetic fertilizer applied to feed crops is utilized, with much of the rest contributing to water pollution. Some is converted into nitrous oxide, an extremely potent heat-trapping gas that contributes to global warming.

The costs of the damage caused by crop externalities may decrease when alternative livestock production methods substitute pasture and perennial forages for grains. Properly maintained perennial pasture builds soil, protects water quality by reducing nutrient runoff and leaching, and captures carbon dioxide—the heat-trapping gas most responsible for global warming—at higher rates than grain crops, apparently even when compared with conservation-tillage systems used with soybeans or corn. It is important to keep in mind, however, that overgrazed or otherwise poorly maintained pasture can also create

<table>
<thead>
<tr>
<th>Sector</th>
<th>Average Annual Subsidy</th>
<th>Average Annual Subsidy per CAFO</th>
<th>Average Annual Subsidy per Large CAFO</th>
<th>Average Reduction in Cost of Production</th>
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</thead>
<tbody>
<tr>
<td>Broilers</td>
<td>$1.25 billion</td>
<td>$766,000</td>
<td>na</td>
<td>13%</td>
</tr>
<tr>
<td>Dairy</td>
<td>$733 million</td>
<td>$223,000</td>
<td>$566,000</td>
<td>0%</td>
</tr>
<tr>
<td>Eggs</td>
<td>$132 million</td>
<td>$360,000</td>
<td>$360,000</td>
<td>13%</td>
</tr>
<tr>
<td>Feedlot Beef</td>
<td>$600 million</td>
<td>$72,000</td>
<td>$2.20 million</td>
<td>6%</td>
</tr>
<tr>
<td>Swine</td>
<td>$945 million</td>
<td>$325,000</td>
<td>$5.01 million</td>
<td>16%</td>
</tr>
<tr>
<td>Total</td>
<td>$3.86 billion</td>
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substantial externalities in the form of land degradation and water pollution.

Ammonia emissions from manure are a major source of water and air pollution, and form fine particulates that can cause respiratory ailments. A summary of several research projects reports that grazing dairy cattle release an average of 6.4 kg of ammonia per cow per year, with 10.5 percent lost to volatilization (the movement of ammonia from manure into the atmosphere as a gas), while dairy cattle in confinement produced 15.5 kg per cow per year, with 22 to 45 percent lost to volatilization and another 13 percent lost during spreading. Pastured dairy cattle thus produce about 0.67 kg of volatilized ammonia per cow as pastured dairy cattle.

Integration of animal and crop agriculture provided by CAFO alternatives generally benefits both types of farming and the environment. An integrated system in Minnesota that tested two different watersheds found that phosphorus in streams was reduced by about 70 percent, nitrogen by 51 to 74 percent, and sediment by 35 to 84 percent. A model integrated regional livestock and crop system in Iowa, with animals in close enough proximity to crops or pasture to replace synthetic nitrogen fertilizer with manure, and where pasture replaced some of the corn and soybeans, could produce livestock with environmental benefits such as reduced water pollution. In addition, the number of finished hogs in this system could actually increase from the current 940,479 head to 7,566,400 within the study area (a watershed). There is clearly a major advantage in linking livestock to crops, which can be readily achieved by relocating livestock near crops.

Impact on global warming

One important externality of livestock production is the emission of heat-trapping gases such as methane. Cattle are a major source of methane, which is produced during both the fermentation of feed in the animal’s gut and the anaerobic fermentation of manure in CAFO lagoons and other manure holding structures.

Cows that feed on pasture or forage produce more methane during digestion than grain-fed cows. Though this may be reduced substantially by optimizing productivity through managed intensive rotational grazing (and by methanotrophic bacteria which are present in biologically active soils -- ed.), it is not clear that methane levels can be reduced to those of grain-fed cattle.

Production of the heat-trapping gas nitrous oxide from the breakdown of fertilizer used to produce grain must also be weighed against the production of nitrous oxide from manure produced by CAFOs and their alternatives. Therefore the net effect on global warming pollution from pasture- versus grain-fed livestock is unclear. It should be noted, however, that although methane production may be about 25 percent higher on pasture operations compared with CAFOs, the atmospheric impact would likely be offset by higher capture of carbon dioxide.

The results of several studies suggest that perennial pasture may capture about 0.9 metric ton of carbon dioxide per hectare per year, while commodity crops in Minnesota—even when grown under conservation tillage—capture only one-third that amount.

On balance, it appears likely that alternative production systems that reduce the size and geographic density of animal feeding operations have substantial benefits compared with CAFOs. It is not possible at this time to determine whether lower global warming pollution is one of those benefits, but alternative integrated animal and crop production systems will likely substantially reduce other externalities associated with CAFOs.

Conclusions

The small sample of studies discussed above cannot be used to draw sharp conclusions about the productivity of alternative animal production methods compared with CAFOs. Many variables can affect both productivity and profitability, including management capability, geography (e.g., regional climate), and availability of processors and markets. Some important parameters also change over time as research develops new innovations and breeds or as the prices of grain, energy, and other inputs change.

Despite these data limitations, however, this overview of alternative animal production and historic trends related to animal feeding operations allows us to draw some broad conclusions about CAFOs and alternative animal production methods. First, although CAFOs often exhibit some minor economies of scale, superior management may often be more important in determining production efficiency in at least some sectors. Well managed smaller to medium-sized swine operations, for example, are as economically efficient as large CAFOs. Alternative systems can often produce animal products cost-effectively, and at a net profit to producers.

Second, the largest obstacle facing alternatives is not the inability to produce animals efficiently, but the effects of processor-related market power. Chal-
Challenges in this regard (vertically coordinated production contracts between CAFOs and processors, elimination of smaller processors, and shrinking of efficient spot markets in some areas) could hamper smaller and alternative producers even when they may otherwise produce animals in a cost-effective and profitable manner.

Finally, alternatives that integrate animal and crop production can provide benefits to farms and society alike, in the form of higher profitability and reduced externalities. Linking manure to cropping systems, for example, creates major economic, social, and environmental benefits for an entire region. Considering the relatively limited research currently available on ways to improve alternative animal farming systems, further research is needed to expand these benefits.

Doug Gurian-Sherman was a senior scientist at the Union for Concerned Scientists (UCS) at the time of this report (2008). The goal of the UCS Food and Environment Program is a food system that encourages innovative and environmentally sustainable ways to produce high-quality, safe, and affordable food, while ensuring that citizens have a voice in how their food is grown. More information about the Union of Concerned Scientists and the Food and Environment Program is available on the UCS website at www.ucsusa.org. The full text of this report is available online (in PDF format) at www.ucsusa.org

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East Hill Tree Farm
Bless up the Earth!
The Real Cost Of Real Food
by Bill Hyde, Happy Farm

Since I was a young boy, I have always wanted to have a farm, even though I have no farming experience or family involvement in farming. Four years ago, nearing retirement, I knew that I was reaching the point of no return: either do it now or it would be too late. So, while most of my friends were contemplating moving to the Southwest or taking up more golf, my wife and I bought seven acres just north of Denver and I began to farm. I learned by doing and by keeping my eyes and ears open. I read a lot. I visited other farms. Immediately I realized I wanted to raise food as naturally as possible. Why put all that effort of morning and evening chores and daytime work into an inferior product?

I also loved giving farm tours to anyone who was interested in coming out to the farm. It seemed a novelty to my friends as well as to me to be doing something so fundamental and yet out of keeping with my business and academic background. Quickly my thinking evolved into more serious consideration of my role as a husband of the soil, plants, and animals on the farm and then onto Wendell Berry, Joel Salatin, and Michael Pollan-type thoughts of principles of sustainability. I gave a few talks to local groups and my thinking evolved further.

Keeping Track Of The Costs
There is a huge disconnect between our food and food supply and what we need as healthy people, and it has all occurred in just the last half century. It is so alarming that I feel compelled to share my experience. From the beginning I kept detailed spreadsheets on all farm activities, the most extensive being my data on producing eggs, the product I started with four years ago. I begin with an overview of our farm and an account of the cost of production and then move to the implications for our future.

All Happy Farm practices promote healthy soil, plants, and animals. Livestock (sheep and goats) live entirely on pasture grazing and are rotated among fields frequently. Pigs and chickens are also rotated from field to field every few weeks. All animals are heirloom varieties. The chickens forage on green fields, eat organic feed and get plenty of exercise. The egg yolks are Halloween orange, due to the high carotene content from the hens eating greens. Salt and pepper are an affront to both the hen who laid the egg (I presume) and one’s taste buds.

The Cost of Pastured Eggs
I generally have 75 to 100 hens. I buy cohorts of day-old chicks. I keep the hens in groups of 15, 25 or 30 per yard or coop to prevent the confusion and fighting that tends to occur among larger groups. Predators are a major problem upon which I will elaborate later. I use portable corrals and mobile tractors so that the chickens are safe and have fresh, green forage whenever the season allows. I buy supplemental feed in bulk (a ton at a time) which is corn-free, soy-free and organic. No antibiotics, pesticides, or synthetics are used for any plant or animal.

The cost categories for my calculation are the following: the chicken, shelter, mobile tractor, feed, utilities, labor, packaging, transportation, land, and supplies. For all items the calculated cost is associated with a dozen eggs. For capital items, the costs are amortized over the anticipated usable life of the property and adjusted for the number of eggs originating from that item. I deliberately used conservative numbers to build a stronger case.

The Chicken
Buying 25- or 50-day-old chicks through a commercial house costs about $3.20 per chick. As the chick must be raised for six months before it lays its first egg, feed costs for the first six months are part of the cost of acquiring an egg-laying hen. Although
a small chicken eats less than an adult chicken, the protein content and, thus, cost per pound, is higher. I calculate 20 pounds at $5.40/pound for a feed cost of $10.80, a conservative estimate. So, the cost of the chicken is now $3.20 plus $10.80 for a total of $14. Not all chicks survive to adulthood. Mortality depends upon lots of things and the mortality rate of my chickens is higher than average because of my initial inexperience and ignorance. For the calculations here, I use a standard ten percent mortality rate due to suffocation, fragility and genetic flaws, which brings the cost to $15.40.

Estimating egg laying rates is difficult, and rates vary according to weather conditions and seasons and bird variety. Commercial bird breeding houses advertise chicken varieties yielding 200, 230 and even 250 eggs a year, but none of my purchases have given such stellar results. In the summer, absent extreme heat, my best egg layers, Leghorn hens, produce two eggs every three days. Barred Rock lay one egg every other day. Buff Orpingtons lay an egg every three days. Other varieties yield similar rates. Hot weather, cold weather, changing the membership of the group of birds living together or moving them to an unfamiliar setting are examples of stressful situations for them that will reduce egg laying. As the days get shorter and colder, production drops drastically to as low as a third of summer yield.

One winter I used lighting for a few hours a day and kept egg production from falling below 50 percent of summer production. Using lighting more extensively would keep production up even more. The industry standard for “natural” lighting conditions requires at least six hours of darkness. I have yet to find a farmer who does not use lights for at least some of the night, but it is not natural. Chickens need a rest from laying and need to conserve vitality after molting. If there ever were a case for seasonal egg laying, it would be winter. Food costs go up during the winter because the birds need more choice. Food costs go up during the winter because egg laying diminishes drastically. Yet I have never observed any seasonal fluctuation in egg laying.

As the days get shorter and colder, production drops drastically to as low as a third of summer yield.

<table>
<thead>
<tr>
<th>Product</th>
<th>Price per Pound</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn</td>
<td>$0.50</td>
</tr>
<tr>
<td>Soybean</td>
<td>$0.60</td>
</tr>
</tbody>
</table>

Aggregating all of these ups and downs in laying activity, I estimate that a new, ready-to-lay hen will produce 240 eggs over the next two years. Dividing the $15.40 cost by the 20 dozen eggs I anticipate to get from the hen comes to $7.7e per dozen. The results are summarized in Table 1.

Shelter

Shelter provides chickens with three essential needs: a place to rest and lay eggs, protection from the elements, and protection from predators. Predators are a particular problem where we are: hawks and owls by air; fox, skunk, and raccoon by land; and one two-legged upright night predator that required my placing locks on the yard gates. I have lost over fifty chickens to animal attacks. I suspect a fox and skunk are responsible. It appears that the skunk eats just the heads; the fox snaps the chickens’ necks for sport. It is too discouraging and costly to have that kind of attrition, so buildings have to be substantial and foraging has to be well managed. I built maximum-security compounds that consist of ten foot by twelve foot sheds using a combination of cinder blocks, lumber and solexx (thin walled greenhouse paneling) for sunlight and heat penetration. Each shed has a completely enclosed (sides and top) chicken wired yard. Even with this space, a small number of birds will strip the area of any green whatsoever within a few days. To provide fresh forage, I use a combination of portable livestock panels to form temporary corrals and mobile chicken tractors that can be moved daily.

The shed calculation is as follows: Each house and enclosed yard costs about $6,000 to build, about half for materials and half for labor. I amortize the useful life over twenty years (although I know that repairs will need to be made before then) and distribute the cost over thirty chickens laying 10 dozen eggs per

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year. The calculation is $6000/20 years = $300 per year. $300/30 chickens = $10/year/chicken. $10 divided by 10 dozen eggs = $1. So, the shelter cost is $11/ dozen.

Chicken Tractor

The chicken tractor is my design and can be moved by one person without upsetting the 15 chicken occupants. There is a chicken wire-enclosed area on the ground with a roosting and nesting area built above it. The cost is about $500 per unit. I estimate a ten-year life (a bit on the financially conservative side as I doubt that the tractors will last ten years without repairs and replacing some parts). The cost per dozen eggs is as follows: $500/10 years = $50 per year. $50 per year/ 15 chickens = $3.33 per chicken per year. $3.33/10 dozen eggs per year = $33/ a dozen.

Feed

A commonly accepted number is five pounds of feed per dozen eggs. However, I believe that outcome is based on more gentle environments than what we have here in Colorado. Foraging during the summer reduces feed costs by as much as 20 percent but the cold temperatures of winter and lack of forage in the winter more than offset savings from foraging. And the overall greater exercise that my chickens get results in about seven pounds of feed per dozen eggs. At forty cents per pound, that is $1/ dozen.

Utilities

Utilities consist of heating water during the winter, both the storage tank and the individual waterers, in each shed. This requires three 60-watt light bulbs. The imputed cost is 11¢ per kilogram of feed per dozen eggs. At forty cents per pound, that is $1/ dozen.

Land

This is another contested item. Some people say that the land will appreciate on its own or that I get to enjoy the tranquility it offers and shouldn’t include it as a cost. While those points may be valid, it is also true that my wife and I could have chosen a less expensive property with less land and used the extra money for investing or taking a special vacation. I don’t have a definite fix on the value that should be placed on land used for farming, but the fact that farming requires land does need to be recognized.

With key financing opportunities and the added protection of payroll support, Red Fire Farm has grown to be one of the largest CSAs in Western Massachusetts. Serving more than 1,500 CSA summer shares, plus 2,000 fruit, egg, flower and winter shares, they’re once again preparing their thriving business for growth.

Ryan Voiland, owner of Red Fire Farm, got started farming while still in high school. Shortly after college graduation, he purchased his first farm and his business has been growing, from the ground up, ever since.

To accomplish their expansion goals and provide adequate shares to a growing client base, the Voiland family has turned to Farm Credit East to help purchase land of their own and expand the business. “I talked with other banks, but Farm Credit East has a much deeper understanding of agriculture,” said Ryan.

Farm Credit East provides much-needed support to farmers throughout New England and the Northeast. The organization offers low-interest loans, flexible financing options, and a wide range of services to help farmers achieve their goals and expand their businesses. With its long history of providing financial assistance to farmers, Farm Credit East is a key resource in the farming community.

In addition to financial assistance for several expansions, the Voiland family discovered that Farm Credit East could also be a key resource in preparing their payroll. “When we first started our business, we hired someone to do our payroll who wasn’t familiar with agriculture and made a number of mistakes,” said Ryan. “That person just didn’t understand the regulations specific to agriculture, so we turned to Farm Credit East.”

The Natural Farmer

Ryan and Sarah Voiland of Red Fire Farm with their son, Wally.
Table 2. Percent of Budget for Food & Health

<table>
<thead>
<tr>
<th>Internet Sources</th>
<th>2010</th>
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<td>18%</td>
<td>19%</td>
<td>20%</td>
</tr>
<tr>
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<tr>
<td>Food &amp; Health</td>
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<td>26%</td>
<td>28%</td>
<td>30%</td>
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Weekly Magazine Sources

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<td>Food &amp; Health</td>
<td>16%</td>
<td>17%</td>
<td>18%</td>
<td>19%</td>
</tr>
</tbody>
</table>

Fixed Costs

It is easy to think that economies of scale can reduce costs, but they tend to result in inferior food and less humane treatment of the animals. Transportation is the only cost category that is fixed; the other costs are variable and increase as size of the operation increases. Let’s hypothesize for a moment. If I had 1,000 chickens instead of 100, the additional requirements for more land, tractors, sheds, utilities, feed, and supplies would increase as the number of chickens increased. Labor would increase as well because the person would have to walk to more places, feed and water more, open and close more, pick up, clean and package more eggs. The only real cost savings is for transportation. Someone has to drive to town to deliver the eggs whether it is to deliver one dozen or one hundred dozen. The cost is almost constant. So, the cost savings might be seventy cents per dozen eggs. Are you ready to pay ten or eleven dollars for a dozen eggs?

Meanwhile, selling the eggs from a thousand chickens is quite different from selling eggs from a hundred. Through a CSA, members subscribe for the season to purchase Happy Farm eggs. During the garden season, all of Happy Farm’s egg-producing capacity is absorbed by the CSA. However, once the last week of the CSA season passes, I scramble to find customers to buy eggs. If I had ten times the number of eggs, the transition would be worse. If I turn to retail businesses, they will want to buy wholesale, whatever that means. To me it means selling the eggs for less, and they would want a year-round supply. (And I would have to include a new egg carton with each dozen.) In short, having more chickens is an invitation for me to offer a greater subsidy to customers.

Incidentally, I do not believe my situation is unique. Most individuals in pursuit of the “super” egg that is free of all bad things and loaded with good things, and sells at nearly the same price as retail store eggs find themselves bouncing from one vendor to another as farmers find their operations too costly and discontinue operations. In Colorado, a family farm with the largest CSA in the state and over 12,000 chickens filed for bankruptcy last year. Another well-established family farm which had sold eggs for decades reliniquished its market.

What We Pay For Food

If my example of the cost of producing eggs is even remotely accurate, there is a huge paradox regarding the cost of food in the United States. In the last fifty years the food supply in the U.S. has undergone massive changes, but most people are unaware of the changes and of the huge significance of the changes. In 1970 we spent about 17 percent of our household income on food. By 2010 we were spending only seven percent of our income on food. (See Table 2.) This simple statistic masks underlying changes that have occurred but it is only part of the story. First and foremost, production of food has been largely taken over by large corporations. The practices of these agribusinesses involve using new chemical and biological products. In some instances we know the compounds are harmful to humans. In other instances it is too soon to tell what the effects might be.

We are not just talking about genetically modified foods that contain substances that the body does not recognize and therefore rebels against. It is not just the processed foods in which fats have been transformed into substances unrecognizable to our digestive systems and disruptive to our metabolic processes. It is not just that many nutrients have been stripped out of foods and replaced with synthetics. It is also the treatment of plants, soils, and animals in large, monoculture farming operations that has changed as well. How many times have we bought a beautiful red tomato only to throw it away after the first bite? Little does the color tell us that it is missing many trace elements and nutrients of its recent ancestors. More disguised is the apple, which may look good and even have a snapiness to the bite, but which has been sprayed so many times that you ingest some of those chemicals with each snappy bite. How good is meat that comes from an animal that is meant to graze but is forced to eat grains exclusively? What becomes of an omnivore like a chicken restricted to a vegetarian diet? The ludicrousness of this high-tech food industry is epitomized by the recent oxymoronic product, ultra-pasteurized organic milk. Organic is what we work...
hard to achieve. Ultra-pasteurization destroys vital enzymes and chemically alters the protein structures so they no longer are totally friendly to the body. Any benefit of being organic is lost through ultra-pasteurization.

The greater affordability of food has come about in part due to these changes and because agribusinesses are not held responsible for soil, air, and water deterioration and pollution that their farming practices create. Neither do they pay for remedying the health problems of farm workers and consumers caused by eating and contacting these so-called foods. Tax policy, in many forms, also favors large agriculture-based corporations.

This food revolution has been successful in large part because the industry has worked hard at concealing its effects from the public, and with every small farm step it takes to distinguish themselves from large agribusinesses, the food industry grants more concessions to the food supply giants. So while food labeling would be a positive step, food corporations lobby immediately to write the regulations in less restrictive language so that their products are not labeled. Unfortunately the FDA, USDA, and EPA, the three key federal public watchdogs meant to look out for consumers’ interests, work in actuality for corporate agriculture. The consumer’s best chance is to follow Michael Pollan’s advice: know the person you buy your food from, know your farmer.

Food Costs Or Health Costs?

During the same period when food costs were decreasing, the percentage of income spent on health increased, offsetting almost precisely the savings from food. Table 2 shows that what we spend for health and food combined is the same now as it was forty years ago.

In sum, we have reached a peculiar place. We have obtained cheap food but it’s a false improvement. As food quality deteriorates, health costs increase—not just one small example, and could be off by ten, twenty, or thirty percent, the overriding conclusion is valid: real food costs substantially more than what U.S. consumers are currently paying for their food-like substances. Second, we in the United States could eat real food if we were willing to pay what the rest of the developed world pays for its food. For example, the Germans and Japanese seem to lead productive, healthy, happy lives even though they pay a lot more for their food (whether it is real food or not).

Real Food Costs More

The purpose of this exercise is to make two points. First, even though the Happy Farm data represent just one small example, and could be off by ten, twenty, or thirty percent, the overriding conclusion is valid: real food costs substantially more than what U.S. consumers are currently paying for their food-like substances. Second, we in the United States could eat real food if we were willing to pay what the rest of the developed world pays for its food. For example, the Germans and Japanese seem to lead productive, healthy, happy lives even though they pay a lot more for their food (whether it is real food or not).

People in the United States pay less for food than any other country in the world. The normal reaction is “This is good.” The slightly cynical person would say, “Isn’t it good?” I should rephrase the original statement. People in the United States pay less for food than any other country in the world. The normal reaction is “This is good.” The slightly cynical person would say, “Isn’t it good?” I should rephrase the original statement. People in the United States pay less for food than any other country in the world. The normal reaction is “This is good.” The slightly cynical person would say, “Isn’t it good?” I should rephrase the original statement. People in the United States pay less for food than any other country in the world. The normal reaction is “This is good.” The slightly cynical person would say, “Isn’t it good?” I should rephrase the original statement. People in the United States pay less for food than any other country in the world. The normal reaction is “This is good.” The slightly cynical person would say, “Isn’t it good?” I should rephrase the original statement.
adapted by Jack Kittredge from a report by Jake Claro published by NOFA-Vermont

How much of the cost of food depends on how it is marketed? Do comparable items have a consistent price relationship when purchased in different venues?

Four years ago NOFA-Vermont published a study of both organic and conventional produce prices, when sold at farmers’ markets, grocery stores, and, for organic items, at food co-ops. The study grew out of a desire to understand why farmers’ markets were seen as a tiny part of the market, especially among low-income buyers. As Jake put it:

The number of farmers’ markets in the United States has precipitously grown in the last two decades, from an estimated 1,755 farmers’ markets 15 years ago to a current figure of 5,274. Vermont alone has experienced a 177% increase in farmers’ markets in the last 15 years, growing from 27 farmers’ markets in 1995 to the current figure of 75. The increase in farmers’ markets over this period corresponds to a growing concern over food production practices and a related increase in demand for locally grown food. Yet, according to USDA estimates, American consumers still only spend approximately 0.2% of their food dollars at farmers’ markets. More troubling, recipients of Supplemental Nutrition Assistance Program (SNAP) benefits spent only 0.008% of their total benefits nationwide at farmers’ markets in 2009.

The Vermont report mentioned earlier studies in Oregon and Iowa which found that consumers perceive farmers’ markets as having higher food prices than grocery stores. Was this perception accurate? The NOFA-VT study aimed to find out.

Five researchers were sent out in July, August and September to 21 venues -- 9 farmers’ markets, 10 grocery stores, and 2 food co-ops. Efforts were made to be sure data collection included the first week of each month because that is when new SNAP benefits are received. Prices were collected for 12 core items, but cucumbers were compared both per pound and per item, and lettuce was compared for mixes and per head. Care was used to make sure items being compared were equivalent. When several vendors at a market all sold the same item, prices for each vendor were recorded. Likewise, if a store sold several varieties of an item, prices for each were used.

The items on which data were collected were:
- Blueberries: Priced per pint.
- Cantaloupe: Priced per pound.
- Corn: Sweet corn on the cob, priced per ear.
- Cucumbers: No pickling varieties or special varieties like European or miniature cucumbers. Priced per pound and priced per cucumber.
- Eggs: Large Grade A, priced per dozen.
- Peppers: Green bell peppers, priced per pound.
- Lettuce: Mesclun and spring mix cut varieties, priced per pound. Head lettuces, priced per head.
- Potatoes: Yukon gold and red skinned potatoes—no fingerlings—priced per pound.
- Peas: Snow peas, priced per pound.
- String beans: Only green—no other colored varieties—priced per pound.
- Squash: Yellow summer squash, priced per pound.
- Tomatoes: Slicing varieties, priced per pound.
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- Squash: Yellow summer squash, priced per pound.
- Tomatoes: Slicing varieties, priced per pound.

The prices per item for each venue were averaged and the results compiled in three comparisons:

- farmers’ market organic versus grocery store conventional
- farmers’ market organic versus grocery store organic, and co-op organic, and
- farmers’ market organic versus grocery store conventional.

The comparative advantage afforded to conventional potato producer operates at a far greater scale than a local Vermont farmer selling at a farmers’ market. The comparative advantage afforded to conventional potato producers through greater scale of production and possibly optimal climatic conditions, therefore, is likely indicated in the price difference for conventional potatoes.

If one were to factor out eggs and potatoes, the average percent difference between the prices of

Figure 1 shows the conventional vs. conventional price comparison results.

<table>
<thead>
<tr>
<th>Item</th>
<th>Farmers' Market</th>
<th>Grocery Store</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blueberries</td>
<td>$4.19</td>
<td>$5.64</td>
</tr>
<tr>
<td>Cantaloupe</td>
<td>$3.40</td>
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<tr>
<td>Corn</td>
<td>$1.20</td>
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<tr>
<td>Cucumbers</td>
<td>$3.88</td>
<td>$5.83</td>
</tr>
<tr>
<td>Eggs</td>
<td>$3.80</td>
<td>$3.22</td>
</tr>
<tr>
<td>Peppers</td>
<td>$2.60</td>
<td>$2.80</td>
</tr>
<tr>
<td>Lettuce</td>
<td>$1.00</td>
<td>$1.20</td>
</tr>
<tr>
<td>Potatoes</td>
<td>$1.40</td>
<td>$1.18</td>
</tr>
<tr>
<td>Snow Peas</td>
<td>$3.00</td>
<td>$2.86</td>
</tr>
<tr>
<td>String Beans</td>
<td>$2.00</td>
<td>$2.24</td>
</tr>
<tr>
<td>Squash</td>
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</tr>
<tr>
<td>Tomatoes</td>
<td>$2.90</td>
<td>$2.16</td>
</tr>
<tr>
<td>Head Lettuce</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cucumbers (each)</td>
<td></td>
<td>$0.80</td>
</tr>
</tbody>
</table>

Figure 1
the remaining 7 conventional items (blueberries, corn, peppers, string beans, squash, tomatoes, and head lettuce) would only be 19.8%, with the lowest percent difference of only 9.57% existing between conventional grocery head lettuce and conventional farmers’ market head lettuce.

Figure 2 shows the organic (farmers market) vs. organic (grocery store) price comparison results.

Organic prices at farmers’ markets were less than organic prices at grocery stores for every item other than potatoes, and less than every item other than cucumbers per pound and potatoes at coops. There is on average a 38.8% difference between the price of organic items that were cheaper at farmers’ markets and the price of organic items at grocery stores, and a 28.7% difference between the farmers’ market organic items and their co-op counterparts. There were no organic observations at grocery stores for

**Figure 2**

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corn, snow peas, or string beans. In fact, only about 17% of total observations at grocery stores were made of organic items. In contrast, about 53% of total observations at farmers’ markets comprised of organic items, indicating that organic producers in Vermont have a healthy share of the overall local market, at least at farmers’ markets. It is also of interest that of the farmers at farmers’ markets who did not have certification, 57% identified their practices as organic.

Figure 3 shows the price comparison between organic items at farmers’ markets with conventional items at grocery stores.

Figure 3 below, shows the price comparison between organic items at farmers’ markets with conventional items at grocery stores.

B-22

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** From Northeast organic farmers to Northeast organic farmers **
farmers’ markets were even less than conventional items at grocery stores. Due to the affordability of organic items at farmers’ markets, consumers who are interested in buying more organic food but who also have budgetary constraints should consider purchasing organic produce at farmers’ markets as a viable alternative to purchasing organic, and, in some instances even conventional items at grocery stores. Not only will they encounter cheaper organic prices, but there is also a good chance that they will have a greater variety of organic produce available to choose from.

Paradoxically, the abundance of organic options at farmers’ markets may be fueling the perception, at least in Vermont, that prices at farmers’ markets are much higher than they are at grocery stores. In one study it was shown that SNAP recipients had the perception that farmers’ markets sold primarily organic items, and that they in turn perceived organic items to be more expensive in general. It is plausible that consumers are constructing their perceptions of organic prices at farmers’ markets based upon their encounters with organic prices at grocery stores. In response, farmers’ markets could more deliberately emphasize the strength of their organic offerings, conveying to consumers that not only are organic prices affordable at farmers’ markets, but the value received for the price is comparatively high – that is consumers are receiving, at a reasonable price, a healthy, locally, and sustainably grown product.
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