TOPIC 12
FOOD FIGHT:
AGRIBUSINESS AND ARTISANAL FARMING

Introduction

There are millions of people in the world today who are suffering from a *lack of food*. Yet, it is also a fact that *global obesity* is steadily on the rise today as well. Thus, given the somewhat startling occurrence of both hunger and obesity in the world today, it is of interest from a moral perspective to investigate some of the questions surrounding food production, distribution and consumption, both locally and globally.

The purpose of this investigation is to see clearly the causes and contributing factors of (and perhaps a solution for) the intractable social justice and distributive justice issues of world hunger, child malnutrition, and food deprivation, on the one hand--especially in the global south—and, on the other hand, the increasing and seemingly unstoppable global obesity epidemic, especially in the global north. What is going on?

Many researchers point to the conflict between two different approaches to food production as a major contributor to the twin problems of obesity and hunger: (1) large, automated, chemical-intensive corporate agribusiness, and (2) small, family-owned, often organic, artisanal farms.

Corporate agribusiness operates from the general position that what is needed is a more intense yield-per-acre of non-expanding agricultural land in order to feed an ever-expanding global population, a yield-per-acre that only technology-driven, precision farming can accomplish. One problem with the corporate argument is that current world food production could already easily meet the food needs of everyone in the world, with plenty left over; and yet many go to bed hungry every night. Almost one quarter of all food is wasted, which alone could feed the world's hungry.

The world food crisis is apparently not the result of scarcity but of poverty and income and wealth inequality and other social, political, and cultural practices. Food subsidies in the U.S., for example, which flow mostly to large, corporate farmers in order to optimize food commodity markets, ends up hurting the small family-owned farm and makes it difficult for them to survive. Check out what economist Joe Stiglitz has to say about farm subsidies in the video at the end of this topic, how they benefit big, corporate farming and hurt the little guy. The Goldman Sachs investment video below lays out the case for this so-called 'precision' approach to farming.

Goldman Sachs: Agribusiness investment video - Precision Farming (2:23)

At the other, consumption end of the food production chain, more food as the result of greater yield per acre means *more food for those who can afford it*. Food supplies, especially meats and expensive processed foods, mass produced from agribusiness sources, flow to the markets of wealthier developed and developing nations in the global north, while the more impoverished or emerging economies of the global south suffer food deprivation, which is especially problematic during the current prolonged famine due to lack of rain in sub-Saharan Africa. To understand the profound existential importance of this situation, we should reflect for a moment on the universal meaning and significance of food and its connection to the human condition.

The fact that there are more than 800 million people suffering from hunger and malnutrition in the world right now is a particularly poignant problem, especially when you consider the nature of food and see this problem of food scarcity alongside the opposite problem of global obesity.

We should keep in mind that food is not merely a commodity among other commodities. Food is life. Food is integral to every aspect of all living things, more so perhaps for us humans because of the added symbolic and social values that food conveys in numerous ways in the human social world. Food is an ultimate or fundamental human value.

Food is certainly the source of our biological nourishment and sustenance, necessary for our being, like air and water. But it is also what brings us together as "loved ones" who belong to families and communities; what Americans celebrate with the Thanksgiving meal. The term "comfort food" suggests how food goes beyond being merely metabolic fuel for proper cell functioning to something that tacitly yet unmistakably conveys love, care and acceptance. Food is our first and most primary connection with the goodness and loving generosity of cosmopolitan life and the fecund earth.

For any person not to have enough to eat when there is more than enough to go around; and for a growing number of other persons becoming obese from too much of the wrong kind of processed food, is a moral tragedy of staggering global proportions with no clear solution in sight. The cause of this double global food crisis is complex because it is tied to other intractable moral issues like global income and wealth inequality.

"You are what you eat" is aptly said. Thus, to reduce food to an economic commodity bought and sold as an investment in the global marketplace which seeks the largest margins in the most lucrative markets; to think of the production of food as an "industry" or a "market" whose robustness is measured in profit and loss rather than as a holistic activity that goes to the core of what it means to be human … this kind of thinking is perhaps already to do damage to the deep personal value of food in human social life and self-consciousness. Food and/or the lack of food is what fits all living things together in the ecological cycle of birth and death, regardless of the trading price of 'food' commodities on the stock market.

Agroecology (the study of ecological processes applied to agricultural production systems) and artisanal farming is a very different approach to farming and the whole idea and meaningfulness of food than the approach of highly mechanized corporate, transnational agribusinesses fueled by the 'Monsanto model'.

In the process of our investigation into the morality of food production and distribution, we will look at one, specific question from among the numerous questions that suggest themselves but which we do not have the time or space to take up here (e.g., corporate animal farming; environmental degradation; labor abuses, child labor, etc.): What I would like to think about is whether the fact that large, multinational agribusinesses driven by higher profit margins rather than

Monsanto (Bayer): the company that owns the world's food supply (13:06)

any higher purpose—agribusinesses engaging in the use of Monsanto produced GMOs and glyphosate pesticides (Roundup) on large, highly mechanized, technologically sophisticated monocrop style farms driven by synthetic chemicals—whether this approach to farming unfairly impacts small, locally owned artisanal farms around the world in both developed and developing nations creating conditions which result in obesity at the well-fed and wealthier end of the scale and malnutrition, deprivation and starvation at the other end.

Artisanal farming or corporate farming: which is the future? Is there any way to resolve the global conflict between small, locally-owned, organic (often, out of necessity), family-oriented and local-job-producing farms in rural areas of poor and emerging nations, and large corporate mega-farms utilizing GMOs and chemical pesticides and fertilizers 'precisely' and extensively incorporating the Monsanto glyphosate model? Which is the best model for the future of humanity?

It is argued that the GMO/chemical monocropping model of transnational agribusiness inhibits the growth of organic farming which, according to some analyses, is a sufficient model to feed the whole world without resorting to environmentally damaging chemically driven food production via the corporate model. Thus, some researchers, such as David Montgomery in the article below entitled "Healthy soil is the real key to feeding the world," believe that we should aspire to small, organic, locally owned and agroecological type of farms which could feed the world's hungry and provide healthier diets. Others argue that this idea is out of step with the times. It ignores the current mass migration away from rural farm areas to find jobs in the city that have resulted from global outsourcing. Thus, the corporate argument goes, there is a demand to produce more per acre to feed a burgeoning world population amassing in cities worldwide.

Unreported World: Obesity in Paradise – What happened in Samoa? How economic development contributes to the obesity epidemic (24:53)

The article Is Samoa's Obesity Epidemic A Harbinger For Other Developing Nations? which is about the current out-of-control obesity epidemic in Samoa, may be instructive for what is happening globally. When Samoa was a poor, isolated Pacific island nation, the population relied on a healthy diet of locally sourced foods. As Samoa developed economically, more people moved from rural farming areas into cities in order to get work, thus increasing the demand for and reliance upon imported food. But the imported food was higher in sugars, salt, fats, preservatives, and overall was less nutritious and more fattening than the native diet it replaced. The only real payoff was that it was convenient and economically available to the faster paced lifestyle of the emerging economy. Due to this change in diet, Samoa now has the highest obesity and diabetes rates of any country in the world. What is the takeaway from the Samoa story? The commodification of food intensifies yield per acre but ironically leads to a less nutritious diet, especially for the swelling ranks of urban-dwelling poor worldwide.

A good indication of what a country can do when the necessity for organic farming is imposed upon it comes from Cuba. After the collapse of the Soviet Union in the 1990's, Cuba could no longer get parts for farm machinery. Fertilizer and herbicides became unavailable. A famine ensued. Cubans responded by growing their own food using ancient methods of organic crop production. Government support helped. Today, chemically free, organic, artisanal farms in Cuba meet more than 50% of the food demand of the island nation while producing jobs for thousands. What will happen as the U.S. lifts the trade embargo? Will U.S. corporate agricultural interests disrupt the Cuban organic market and create a 'Samoa effect'?

What Cuba can teach America about organic farming (6:15)

The benefits of small, locally owned farms has led numerous states in the U.S. to pass laws restricting the corporate ownership of farms, as happened recently in North Dakota.

But global agribusiness is intertwined with global politics, operating at a level beyond the reach of small, local, independent and self-sufficient family farmers. These folks are often barely able to make ends meet. Lacking governmental support like the corporate farmers, they end up being forced out of business by large agribusinesses that survive on generous government subsidies. Colin Todhunter, in his article below, gives an account of this situation. His evaluation and thoughts about the Cuba model versus the U.S. model are particularly interesting. He argues that organic farming could be a great benefit in the fight against world hunger, especially in the Global South which has almost a billion people who are food challenged. But small, locally owned organic farming, it is claimed, is being forced out by large multinational agribusinesses thriving on government subsidies and driven by the use of GMOs along with chemical fertilizers and pesticides. These agribusinesses are dominating production, processing and distribution of food within the world food market today. But, should they be?

Joseph Stiglitz, Nobel Prize-winning Economist: Corporate Farming Subsidies are Agribusiness mega welfare (3:18)

Family farmers fight corporations in North Dakota (3:04)

Global hunger and global obesity on the rise

John Tozzi and Jeremy Scott Diamond

The World Is Getting Fatter and No One Knows How to Stop It[1]

Humanity is putting on weight. Across the globe, in wealthy countries and developing nations, among children and adults, an increasing number of people are overweight or obese. Today, nearly 40 percent of the world's adults fall into one of those categories, according to new estimates by a global network of researchers called the NCD Risk Factor Collaboration.

Economic forces are conspiring to cause the great global weight gain. Countries grow wealthier and increase consumption. People move from rural areas to cities, where they have ready access to inexpensive, processed foods. Machines do work that humans once did, decreasing the amount of energy people use. And global trade means the reach of junk food has never been greater. Up against these trends, no country has figured out how to reverse the rise of obesity.

In 2014, there were 114 countries where more than half the adult population was considered overweight, including much of the Americas, Europe, and the Middle East, according to World Health Organization data. In small Pacific Island nations and Persian Gulf states, more than two-thirds of the population is considered overweight or obese, a higher prevalence than in the United States.

Researchers estimate that excess weight caused 3.4 million deaths worldwide in 2010. Being overweight or obese is a risk factor for chronic conditions like cardiovascular disease and diabetes. Those are rising worldwide, too. There were an estimated 422 million adults with diabetes in 2014, a rate of 8.5 percent, compared to 4.7 percent in 1980, according to new estimates published by the World Health Organization April 6.

Diabetes is rising fastest in low- and middle-income countries. It's most common in the region that includes the Middle East and North Africa, where levels of physical inactivity are high.

---

[1] Tozzi, John and Diamond, Jeremy S. "The World Is Getting Fatter and No One Knows How to Stop It." Bloomberg. April 6, 2016. https://www.bloomberg.com/graphics/2016-global-obesity/

The number of people who are overweight or obese is going up pretty much everywhere. The world has made progress against health threats from smoking and malnutrition to malaria and waterborne illnesses. No country has yet reversed the obesity epidemic. “Not only is obesity increasing, but no national success stories have been reported in the past 33 years,” researchers in the *Lancet* wrote in a 2014 report funded by the Bill & Melinda Gates Foundation.

A United Nations plan published in 2013 calls for halting the rise in diabetes and obesity by 2025. Though the pace of increase has slowed in some places, *Lancet* researchers recently called the chances of the world meeting that target “virtually zero.”

So what’s causing obesity?

The causes of the worldwide weight gain are complicated, and the story is different from country to country. There are some common trends: Rising incomes, global trade, changing food supplies, and declines in physical activity all contribute.

The world has a lot more food than it once did. For most of history, humans struggled to get enough to eat. Now, in many countries, the food supply is more than sufficient to provide the energy people need. It’s difficult to measure how much people actually eat, but estimates of the calories available for consumption show they’ve steadily climbed over the past half century.

That transformation has unquestionable benefits, with millions of people avoiding starvation and malnutrition. But the increase in obesity, diabetes, and other chronic diseases indicates that too much food —and less healthful food, especially— can have harmful effects on a population as well.

Today, the majority of humanity lives in cities. Work, play, and transit involve less physical activity than they did in an era before computers, televisions, and cars. Globally, almost one-third of adults don’t get the recommended level of physical activity, according to research published in 2012.

There may be other factors that we don’t fully understand, such as genetics, changes to humans’ gut bacteria, or chemicals in the environment that influence our metabolism.

What can be done about obesity?

Increased food availability, growing global wealth, and urbanization are likely to continue. In the United States, obesity plateaued in the first decade of the 21st

century, and among the youngest children it may be decreasing. To turn the trend around, Mexico began taxing sugary beverages in 2014, with early indicators showing soda sales declining.

With obesity trends intertwined with economic forces, some advocates say that health considerations need to be written into trade and economic policies, like the Trans-Pacific Partnership. The trade deal, currently being considered by 12 nations, including Japan, Australia, Mexico, Canada, and the United States, would lower tariffs on food products like meat, dairy, and sugar, potentially increasing the availability of cheap food.

The trade agreement could also empower corporations to challenge governments' attempts to fight obesity through food labeling laws or subsidies for more nutritious goods.

The course of the obesity epidemic won't rest on the TPP alone. But it might depend on how well countries can balance the health of their people with the global forces shaping their economies.

Agribusiness and Agroecology

COLIN TODHUNTER

Global Agribusiness, Dependency and the Marginalisation of Self-Sufficiency, Organic Farming and Agroecology[2]

Condensed version

Is organic-based farming merely a niche model of agriculture that is not capable of feeding the global population? Or does it have a major role to play?

In addressing these questions, it would be useful to consider a selection of relevant literature to see what it says about the role of organic farming, how this model of agriculture impacts farmers and whether or not it can actually feed the global population.

Organic farming and sustainable livelihoods

In 'The impact of organic farming on food security in a regional and global perspective', Halberg et al (2006) argue that while present food production in theory is sufficient to cover the energy and protein needs of the global population, there are still more than 740 million food insecure people, the majority of whom live in the Global South. The researchers indicate that if a conversion to organic farming of approximately 50% of the agricultural area in the Global South were to be carried out, it would result in increased self-sufficiency and decreased net food import to the region.

Following on from this, in the 2013 book 'Organic Agriculture for Sustainable Livelihoods' by Halberg and Muller, the authors suggest that organic crops tend to provide farmers with a higher net income compared to their conventional counterparts due to lower production costs. The book provides convincing evidence that organic farming has a positive influence on smallholder food security and

[2] Todhunter, Colin. "Global Agribusiness, Dependency and the Marginalisation of Self-Sufficiency, Organic Farming and Agroecology." RINF (Real Independent News & Film) March 28, 2016. www.rinf.com
http://rinf.com/alt-news/editorials/global-agribusiness-dependency-marginalisation-self-sufficiency-organic-farming-agroecology/

livelihoods. This is important because smallholder agriculture is key to food production in the Global South, where food insecurity is most prevalent.

Aaron Iverson makes a pertinent point about this book: Halberg and Muller factor into their analyses the economic benefits of organic agriculture over conventional agriculture, which accrue over several years to decades. Iverson says that such analyses on these time scales are rare. Based on extensive research and modelling, the two authors indicate that organic farming promotes crop diversity, improves worker health due to less chemical exposure, increases social and human capital, increases farmland biodiversity, lowers pollution, increases soil fertility and is less financially risky due to lower upfront costs. Among other things, it also sequesters more soil carbon and is less vulnerable to climate change due to improved soil properties.

UN FAO: organic could feed the world

In 2007, the UN FAO (Food and Agriculture Organization) noted that the advantage of organic agriculture is that it relies on fossil-fuel independent and locally-available production assets. Organic models work with natural processes, increase cost-effectiveness and contribute to resilience in the face of climatic stress. The FAO concluded that by managing biodiversity in time (rotations) and space (mixed cropping), organic farmers use their labour and environmental factors to intensify production in a sustainable way and that organic agriculture could break the vicious circle of indebtedness for agricultural inputs, which causes an alarming rate of farmers' suicides.

The FAO recognises that agroecology contributes to improved food self-reliance, the revitalisation of smallholder agriculture and enhanced employment opportunities. It asserts that organic agriculture could produce enough food on a global per capita basis for the current world population but with reduced environmental impact than conventional agriculture.

In a similar vein, although not focusing solely on organic, Jules Pretty et al note that sustainable, resource-conserving agriculture has the potential to significantly increase yields. It also improves nutrition, food security and crop diversity (contrast this with what Daniel Miangi says about the chemical-intensive mono-cropping system and its adverse impact on diet).

UN Special Rapporteur on agroecology and the right to food

Olivier De Schutter, former UN special Rapporteur on the right to food, produced this report in 2011 that was based on an extensive review of recent

scientific literature. He concludes that, by applying agroecological principles to the design of democratically controlled agricultural systems, we can help to put an end to food crises and address climate-change and poverty challenges. He is not the only one who asserts organic farming is better suited to addressing climate-related challenges. This peer-reviewed paper also argues that organic is a "concrete and sustainable option" for adapting to climate change and variability.

De Schutter argues that agroecological approaches could address food needs in critical regions and could double food production in 10 years.

His report focused on regions like Africa and South East Asia and showed an average crop yield increase of 80% in 57 developing countries, with an average increase of 116% for all African projects. Recent projects conducted in 20 African countries demonstrated a doubling of crop yields over a period of 3-10 years. However, De Schutter notes insufficient backing for organic-based farming seriously hinders progress.

And this last point should not be understated. For instance, the success of the green revolution is often touted, but how can we really evaluate it? If alternatives had been invested in to the same extent, if similar powerful and influential interests had invested in organic-based models, would we now not be pointing to the runaway successes of organic-based farming and, importantly, without the massive external costs of a polluted environment, less diverse diets, degraded soils and nutrient deficient food, ill health and so on?

And if green revolution technology and thinking had not been wedded to and fueled and driven by powerful commercial and geopolitical interests, would it not have been employed more judiciously to serve farmers and the public better?

UNCTAD: better incomes and food availability

In 2012, the Deputy Secretary General of the UN Conference on Trade and Development (UNCTAD), Petko Draganov, during the opening of the 2nd African Organic Conference in the Zambian capital, Lusaka, stated:

"Organic agriculture can offer an impressive array of food security, economic, environmental, and health benefits for developing countries, including in Africa."

He went on to state that expanding Africa's shift towards organic farming will have beneficial effects on the continent's nutritional needs, the environment, farmers' incomes, markets and employment.

According to UNCTAD, organic agriculture can increase farm yields markedly and help farmers receive higher prices for their produce, which sells at a premium. The method also helps create jobs in rural areas.

A meta analysis conducted by UNEP–UNCTAD (2008) assessed 114 cases in Africa. In Kenya, maize yields increased by 71% and bean yields by 158%. Increased diversity in food crops available to farmers resulted in more varied diets and thus improved nutrition. The 114 projects covered 2 million hectares and 1.9 million farmers showing a 116% higher average crop yield on average for all African projects and 128 higher for the projects in East Africa. The UN agencies concluded that organic agriculture can be more conducive to food security in Africa than most conventional production systems and that it is more likely to be sustainable in the long term. These projects increased food availability for local people and gave the farmers involved higher incomes.

IAASTD recommends agroecology

The IAASTD peer-reviewed report, produced by 400 scientists and supported by 60 countries, recommends agroecology to maintain and increase the productivity of global agriculture. It cites the largest study of sustainable agriculture in the Global South, which analysed 286 projects covering 37 million hectares in 57 countries, and found that on average crop yields increased by 79% (the study by Pretty et al, referred to earlier – which includes 'resource conserving' non-organic conventional approaches).

The purpose of listing these reports is to show that there is enough evidence to demonstrate that organic-based approaches are vital for guaranteeing food security, rural development, better nutrition and sustainability, especially in the Global South.

The Cuban model

Aside from the evidence provided above, there are numerous other studies which testify to the efficacy of organic farming: for example, there are reports/studies from the Rodale Institute, Oakland Institute, Women's Collective of Tamil Nadu, Newcastle University, UN Green Economy Initiative and Washington State University. We also need look no further than the results of organic-based farming in Malawi. Organic approaches have also enhanced farmers' livelihoods in India and play a key role in contributing to rural development.

However, if we want to really appreciate what happens when a major widespread shift to organic farming occurs, we need look no further than Cuba.

Cuba is the one country in the world that has made the biggest changes in the shortest time in moving from industrial chemical-intensive agriculture to organic farming.

Miguel Altieri notes that, due to the difficulties Cuba experienced as a result of the fall of the USSR, it moved towards organic and agroecological techniques in the 1990s. Thousands of oxen replaced tractors that could not function due to lack of petroleum and spare parts. Farmers substituted green manures for chemical fertilizers and artisanally produced biopesticides for insecticides.

Altieri states that from 1996 to 2005, per capita food production in Cuba increased by 4.2 percent yearly during a period when production was stagnant across the wider region. In the mid-2000s, the Ministry of Agriculture endorsed the creation of 2,600 new small urban and suburban farms and allowed farming on some three million hectares of unused state lands.

Today Cuba has 383,000 urban farms, covering 50,000 hectares of otherwise unused land and producing more than 1.5 million tons of vegetables. The most productive urban farms yield up to 20 kg of food per square meter, the highest rate in the world, using no synthetic chemicals. Urban farms supply 50 to 70 percent or more of all the fresh vegetables consumed in cities such as Havana and Villa Clara.\

Altieri and his colleague have calculated that if all peasant farms and cooperatives adopted diversified agroecological designs, Cuba would be able to produce enough to feed its population, supply food to the tourist industry and even export some food to help generate foreign currency.

What Cuba has done is a major achievement, as Garry Leech argues:

"The shift to a more ecologically sustainable agricultural production has resulted in healthy organic food being the most convenient and inexpensive food available to Cubans. Because of the US blockade, processed foods are more expensive and not readily available. This reality stands in stark contrast to that in wealthy capitalist nations such as the United States and Canada where heavily-subsidized agri-businesses flood the market with cheap, unhealthy processed foods while organic alternatives are expensive and more difficult to obtain. The consequence in the United States is high levels of obesity, diabetes and heart disease."

Cuba shows what can be done (see how it was done and the dangers it now faces) when the political will exists and what should be done if we are to move away from an unsustainable model of agriculture that creates food insecurity, environmental degradation, bad food and ill health.

The US model

Contrast this with what NAFTA did to Mexico. Driven by an industrial chemical-intensive US model of food processing, retail and agriculture, the outcome has been bad health, the undermining of food security and the devastation of small farmers and businesses.

Processed junk food ridden with toxins and a propped up agribusiness sector with subsidies has become a feature of the US chemical-intensive model of agriculture, which has led to all kinds of health and environmental problems in the US, as highlighted here.

For Olivier De Schutter, a programme that deals effectively with hunger and malnutrition has to focus on Mexico's small farmers and peasants. They constitute a substantial percentage of the country's poor and are the ones that can best supply both rural and urban populations with nutritious foods.

And the writing is on the wall for places like India too as the neoliberal invasion and transnational agribusiness armed with its chemicals (and GMOs) increases its hold over food and agriculture. It is turning out to be disastrous for Indian farmers, the environment and the health of the public (see this too).

In the meantime, supporters of the unhealthy, unsustainable, industrialised petro-chemical model of agriculture wish to continue to rip up indigenous agriculture and recast it accordingly. And they attempt to justify this by stating there is no alternative and that organic-based approaches, including a genuine democratic-participatory movement like agroecology, cannot deliver.

Despite places like Russia, Cuba and Sikkim (India's first fully organic state) are showing the way forward, these supporters would say that, wouldn't they?\

From NAFTA and trade agreements like the Knowledge Initiative on Agriculture (India), TTIP and TPP to the ongoing infiltration of Africa by Bill Gates and 'corporate America', they require business as usual: to offer governments strings-attached loans and ensure export cash-crop monocropping takes hold (see this article from 1999 about India), to make farmers reliant on external inputs, to get them onto a highly profitable but unsustainable GMO/chemical treadmill and to incorporate them into an system of globalisation centred on rigged trade, debt traps and the manipulated international 'free' market.

And all for what? To capture the entire supply chain from seed to plate, to serve the commercial interests of transnational agritech/agribusiness and food retail corporations and to use agriculture as a political tool to create dependency. All of this at the expense of self-sufficiency, sustainable indigenous agriculture and the livelihoods of those involved in traditional food production, processing and retail.

And all of this too at the expense of regional food security, the environment and a nutritious, healthy and diverse diet.

Colin Todhunter *is an extensively published independent writer and former social policy researcher based in the UK and India.*

Healthy soil is the most important of all

David R. Montgomery

(Professor of Earth and Space Sciences, University of Washington)

Healthy soil is the real key to feeding the world[3]

One of the biggest modern myths about agriculture is that organic farming is inherently sustainable. It can be, but it isn't necessarily. After all, soil erosion from chemical-free tilled fields undermined the Roman Empire and other ancient societies around the world. Other agricultural myths hinder recognizing the potential to restore degraded soils to feed the world using fewer agrochemicals.

When I embarked on a six-month trip to visit farms around the world to research my forthcoming book, "Growing a Revolution: Bringing Our Soil Back to Life," the innovative farmers I met showed me that regenerative farming practices can restore the world's agricultural soils. In both the developed and developing worlds, these farmers rapidly rebuilt the fertility of their degraded soil, which then allowed them to maintain high yields using far less fertilizer and fewer pesticides.

Their experiences, and the results that I saw on their farms in North and South Dakota, Ohio, Pennsylvania, Ghana and Costa Rica, offer compelling evidence that the key to sustaining highly productive agriculture lies in rebuilding healthy, fertile soil. This journey also led me to question three pillars of conventional wisdom about today's industrialized agrochemical agriculture: that it feeds the world, is a more efficient way to produce food and will be necessary to feed the future.

Myth 1: Large-scale agriculture feeds the world today

According to a recent U.N. Food and Agriculture Organization (FAO) report, family farms produce over three-quarters of the world's food. The FAO also estimates

[3] Montgomery, David, R. "Healthy soil is the real key to feeding the world." The Conversation April 3, 2017 www.theconversation.com https://theconversation.com/healthy-soil-is-the-real-key-to-feeding-the-world-75364

that almost three-quarters of all farms worldwide are smaller than one hectare – about 2.5 acres, or the size of a typical city block.

Only about 1 percent of Americans are farmers today. Yet most of the world's farmers work the land to feed themselves and their families. So while conventional industrialized agriculture feeds the developed world, most of the world's farmers work small family farms. A 2016 Environmental Working Group report found that almost 90 percent of U.S. agricultural exports went to developed countries with few hungry people.

Of course the world needs commercial agriculture, unless we all want to live on and work our own farms. But are large industrial farms really the best, let alone the only, way forward? This question leads us to a second myth.

Myth 2: Large farms are more efficient

Many high-volume industrial processes exhibit efficiencies at large scale that decrease inputs per unit of production. The more widgets you make, the more efficiently you can make each one. But agriculture is different. A 1989 National Research Council study concluded that "well-managed alternative farming systems nearly always use less synthetic chemical pesticides, fertilizers, and antibiotics per unit of production than conventional farms."

And while mechanization can provide cost and labor efficiencies on large farms, bigger farms do not necessarily produce more food. According to a 1992 agricultural census report, small, diversified farms produce more than twice as much food per acre than large farms do.

Even the World Bank endorses small farms as the way to increase agricultural output in developing nations where food security remains a pressing issue. While large farms excel at producing a lot of a particular crop – like corn or wheat – small diversified farms produce more food and more kinds of food per hectare overall.

Myth 3: Conventional farming is necessary to feed the world

We've all heard proponents of conventional agriculture claim that organic farming is a recipe for global starvation because it produces lower yields. The most extensive yield comparison to date, a 2015 meta-analysis of 115 studies, found that organic production averaged almost 20 percent less than conventionally grown crops, a finding similar to those of prior studies.

But the study went a step further, comparing crop yields on conventional farms to those on organic farms where cover crops were planted and crops were rotated to build soil health. These techniques shrank the yield gap to below 10 percent.

The authors concluded that the actual gap may be much smaller, as they found "evidence of bias in the meta-dataset toward studies reporting higher conventional yields." In other words, the basis for claims that organic agriculture

can't feed the world depend as much on specific farming methods as on the type of farm.

Consider too that about a quarter of all food produced worldwide is never eaten. Each year the United States alone throws out 133 billion pounds of food, more than enough to feed the nearly 50 million Americans who regularly face hunger. So even taken at face value, the oft-cited yield gap between conventional and organic farming is smaller than the amount of food we routinely throw away.

Building healthy soil

Conventional farming practices that degrade soil health undermine humanity's ability to continue feeding everyone over the long run. Regenerative practices like those used on the farms and ranches I visited show that we can readily improve soil fertility on both large farms in the U.S. and on small subsistence farms in the tropics.

I no longer see debates about the future of agriculture as simply conventional versus organic. In my view, we've oversimplified the complexity of the land and underutilized the ingenuity of farmers. I now see adopting farming practices that build soil health as the key to a stable and resilient agriculture. And the farmers I visited had cracked this code, adapting no-till methods, cover cropping and complex rotations to their particular soil, environmental and socioeconomic conditions.

Whether they were organic or still used some fertilizers and pesticides, the farms I visited that adopted this transformational suite of practices all reported harvests that consistently matched or exceeded those from neighboring conventional farms after a short transition period. Another message was as simple as it was clear: Farmers who restored their soil used fewer inputs to produce higher yields, which translated into higher profits.

No matter how one looks at it, we can be certain that agriculture will soon face another revolution. For agriculture today runs on abundant, cheap oil for fuel and to make fertilizer – and our supply of cheap oil will not last forever. There are already enough people on the planet that we have less than a year's supply of food for the global population on hand at any one time. This simple fact has critical implications for society.

So how do we speed the adoption of a more resilient agriculture? Creating demonstration farms would help, as would carrying out system-scale research to evaluate what works best to adapt specific practices to general principles in different settings.

We also need to reframe our agricultural policies and subsidies. It makes no sense to continue incentivizing conventional practices that degrade soil fertility. We must begin supporting and rewarding farmers who adopt regenerative practices.

Once we see through myths of modern agriculture, practices that build soil health become the lens through which to assess strategies for feeding us all over the

long haul. Why am I so confident that regenerative farming practices can prove both productive and economical? The farmers I met showed me they already are.