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The Massive Food and Land Costs of U.S. Corn Ethanol An Update

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My 2006 CEI *Issue Analysis*, "Biofuels, Food, or Wildlife? The Massive Land Costs of U.S. Ethanol," concluded that the United States did not have enough cropland to make a significant dent in its transport fuel demand without risking radically higher food prices, while suffering a massive loss of forests and grasslands to expanded corn production.

Yet even I have been astounded at the swift onset of food shortages and high crop prices which have ensued since. According to the World Bank, global food prices have increased by an average of 83 percent over the 36 months to April 2008, during which time the United States diverted ever increasing amounts of corn into ethanol.[1] At the same time, European nations were increasingly diverting rapeseed and imported palm oil into biodiesel, and the Canadian province of Saskatchewan was building plants to ferment more than 1.4 million tons of wheat per year into wheat ethanol.[2]

The World Bank's analysis shows that, from 2004 to 2007, global corn production increased by 51 million tons, biofuel use in the U.S. increased by 50 million tons, and global consumption for all other uses increased by 33 million tons—causing global stocks to decline by 30 million tons.[3] In other words, biofuels have made the world use more corn than it can sustainably produce, creating massive food price hikes.

Soaring Global Food Prices. The recent food inflation has impacted the food security of perhaps 100 million people, causing food riots and political unrest in more than 30 countries. Sharply higher costs for meat, milk, and eggs are about to affect even more people as the radically higher costs of feed ripple through the farming industry. For the first time in modern farming history, high prices will not be a short-term interruption of a long-term trend of declining food costs—they are here to stay for as long as we

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continue to turn food into fuel. As a result, the oil price inflation—grossly exacerbated by America's eschewing of other fossil fuels and nuclear power—will continue to translate into steep price hikes for just about everything.

Some observers have blamed part of the price increase on rising grain and oilseed demand in newly affluent China and India. However, virtually all of the recent increases in Chinese and Indian consumption have been met by local suppliers, with a minimal impact on the world market. China in 2007 actually *exported* 2 million tons more grain than it imported. India exported a modest amount of corn and 3.5 million tons of rice, while importing about 2 million tons of wheat.[4]

The impact of China and India on world prices for vegetable oils was more significant, but hardly accounts for the global surge in commodity prices. China continued to gradually increase its soybean imports, which have risen from 17 million tons in 2003-2004 to 35 million tons in 2007-2008—an increase of about 4.5 percent of world oilseed production over a four-year period. India has long been an importer of palm oil; its 2007 imports, at 4.2 million tons, were only slightly larger than the average for previous years.[5]

All over the world, new demand for cropland to supply transport fuel is rippling out across the plains and valleys, threatening hunger and poverty for the poor and triggering food inflation for everybody else. Corn farmers benefit as livestock farmers go broke. Consumers become scared—and political unrest will likely intensify as meat, milk, and eggs become priced beyond their imaginings. In Thailand, recent high corn and vegetable oil prices have tempted Thai farmers to grow more corn and vegetable oil—and less rice. American wheat farmers have been reluctant to expand wheat plantings this year because they suspect corn will still return more per acre than wheat.

What about the impact of biofuels on the price of bread? In 2006, *The New York Times* reported on the shift to corn in what had been America's Wheat Belt—only 14 months after the Bush biofuels mandate was enacted:

> Once the driving force behind transforming the United States into the "breadbasket of the world," wheat is being steadily replaced by corn as the crop of choice for American farmers. Genetic modifications to corn seeds, *the growing demand for corn-based ethanol as a fuel blend and more favorable farm subsidies are leading farmers to plant corn in places where wheat long dominated*.[6] [Emphasis added.]

Oil Price Unaffected. None of this has made a visible dent in the price of oil. How could it, when politicians have essentially barred the use of coal and nuclear power, and actively hindered the drilling, refining, and transport of oil and gas? A recent ad campaign by the Renewable Fuels Association claims that ethanol keeps gasoline prices about 50 cents per gallon lower than they would be otherwise. This claim is based on an estimate by Merrill Lynch analyst Francisco Blanch, who in late March told *The Wall Street Journal* that, without the increase in biofuel production over the past year, oil and gasoline prices would be 15 percent higher.[7] As the *Journal* notes, this means that oil

prices would have been $115 a barrel instead of $102 a barrel. But only six weeks later, oil was selling at $120 a barrel, and between late March and early May there was no cutback in biofuel production. Crude oil prices climbed to $147 a barrel in July before collapsing with the collapse of global stock markets and fears of a potential recession. Thus, there is no good reason to believe that biofuels have kept prices down at any time.

The food price problem is a simple one: People must eat just about as much food to stay healthy whether it is costly or cheap. That is known as *inelastic demand*. When we add new biodiesel demand, that is also inelastic because of a government mandate that skims its share off the top of the grain bins. Thus, high fuel costs turn into general inflation.

Ethanol by the Numbers. Corn today yields about 50 gallons' worth of gasoline per acre per year, and we burn 135 billion gallons of gasoline annually. World food prices have nearly doubled. There is no documentation that gasoline prices have been moderated by even a single percentage point. The fact is, ethanol is *more expensive* than oil.

In 2007, while corn plantings increased by 19 percent, soybean, cotton, and rice plantings decreased by 16, 18, and 3 percent, respectively. Wheat plantings did not decline last year, but are expected to decline slowly in the years ahead, according to the U.S. Department of Agriculture (USDA). USDA says that in the years just ahead, "Strong expansion of corn-based ethanol affects virtually every aspect of field crops," which will keep prices at "historically high levels." USDA notes that U.S. corn ethanol production totaled 3 billion gallons in 2003, 6 billion in 2007, and is projected to reach 12 billion gallons by 2010.[8]

Last year, high corn prices helped drive U.S. farmers into planting corn instead of soybeans, wheat, and cotton. This year's ethanol demand is still not satisfied, and the other crops' prices are bidding back. Expect the roar of chainsaws and the clank of tilling machines as more forests and wetlands are converted to cropland. Millions of acres of U.S. Conservation Reserve lands are coming out of conservation and back into cultivation. Bruce Babcock of Iowa State University notes that the current price for corn implies that all of the cropland in the Corn Belt is suddenly worth twice as much as before. He asks, "When Will the Bubble Burst?"[9] The inexorable forces of economics demand that more land must and will be converted for crops—especially for corn. However, wheat, too can be fed to livestock and used for ethanol.

At a Washington briefing on my 2006 paper, an auto company executive expressed disappointment at my position on biofuels. He said he had always considered me to be an optimist on rising crop yields. I said that I remain an optimist about higher crop yields, but I'm not an idiot.

Were we to double corn yields, we still would not have enough room for corn ethanol, because global food and feed demand will double again by 2040. United Nations analysts expect world population to peak at around 8 to 9 billion people by 2050.[10] Human numbers are then expected to slowly decline, but any species lost to biofuels in the next

few decades will have been lost forever. Indonesia's orangutans are prime candidates for biodiesel extinction. Affluence is still spreading, and by 2050, we should expect that 7 billion people will be able to afford meat, milk, and other resource-intensive calories, up from perhaps 1.5 billion today. These people will have fewer children, but they will also have more pets—almost none of them vegetarian. The Center for Global Food Issues, of which I am director, estimates that the world will need 2.5 times as much food and feed in 2050 as we consume today.

Nor does the world have much more good quality land on which to expand crop production. The acid-soil Cerrados Plateau in western Brazil is one of the few places where more crops can be planted without prompting massive soil erosion.[11] Even the Cerrados is sustainable only because of the development of no-till farming with herbicides, and is productive due to new acid-tolerant crop varieties developed by Brazilian government scientists.

To date, farming has used the best quality arable land, which never had much biodiversity. Instead, it had large populations of a few species, such as the bison on the Great Plains and the kangaroo in the Australian Outback. Today, there is very little good agricultural land left. The Amazon has an estimated 2.5 million species of insects, along with at least 40,000 plant species, 2,000 bird and mammal species, and 3,000 fish species.[12] Indonesia, by comparison, has at least 35,000 species not including insects.[13] The future of the world's wildlife is more threatened by biofuels than by global warming—especially since written histories and temperature proxies such as cave stalagmites from the Medieval and Roman warm periods tell us the wild species have been through warmth before.

All of this leaves no room for biofuels—and not much for the much lower yields of organic farming.

Biofuels Sharply Increase Greenhouse Gas Emissions. In addition to the problems already mentioned, biofuels have actually been increasing global greenhouse gas emissions. Agricultural researchers have long known that forests and grasslands store large amounts of carbon in their soils—far more carbon than is contained in the atmosphere. When these native soils are plowed and cropped, soil carbon gasses off rapidly. This soil carbon loss was not carefully examined, however, when the biofuels fever swept over developed countries' energy-hungry economies during the past half-dozen years.

Now new studies document the additional greenhouse gases produced when biofuels take over forests, grasslands and peatlands. Virtually all of the world's biofuels must ultimately be grown on such "converted" native habitat since almost all of the world's prime cropland was already being cultivated before biofuels mandates were issued—and world food and feed demand is likely to at least double again by 2050.

The first study to call attention to the loss of soil carbon when biofuel plantings expand, by Renton Righelato of the World Land Trust and Dominick Spracklen of the University

of Leeds, in the journal *Science*,[14] notes that the necessary land clearing would mean "the rapid oxidation of carbon stores in the vegetation and soil, creating a large up-front emissions cost that would, in all cases examined, outweigh the avoided emissions." The authors also report that life-cycle analyses on ethanol from sugar cane, sugar beet, wheat, and corn all found that, "forestation of an equivalent area of land would sequester two to nine times more carbon over a 30-year period than the emissions avoided by the use of the biofuel."

Two more papers in the February 29, 2008, issue of *Science* revisited the "carbon debt" created when forests and grasslands are converted to biofuel crops. Joseph Fargione of the Nature Conservancy and researchers from the University of Minnesota made detailed calculations for six different scenarios of native habitat destruction: Brazilian Amazon to soybean biodesel, Brazilian Cerrado to soybean biodiesel, Brazilian Cerrado to sugarcane ethanol, Indonesian or Malaysian lowland tropical forest to palm oil biodiesel, Indonesian or Malaysian peatland tropical rainforest to palm biodiesel, and U.S. central grassland to corn ethanol. They concluded that these habitat losses would release "17 to 420 times more CO_2 than the annual greenhouse reductions that these biofuels would provide by displacing fossil fuels." Clearing peatland for oil palm—to produce European biodiesel—was the worst of all the biofuel eco-sins.[15]

Tim Searchinger of Princeton University and several co-authors conclude that, "corn-based ethanol, instead of producing a 20 percent savings, nearly doubles greenhouse emissions over 30 years, and increases greenhouse gasses for 167 years," while "biofuels from switchgrass, if grown on U.S. corn lands, increase emissions by 50 percent."[16]

One of Searchinger's co-authors was David Tilman of the University of Minnesota, who in 2001 co-authored a *Science* study with Fargione[17] in which they warned that the world's redoubled demand for food and feed in 2050 would appropriate more than two-thirds of terrestrial ecosystem production, and demand virtually all of the Earth's usable fresh water—before any resource demands from biofuels were even considered!

Craig D. Idso and Keith Idso, researchers at the Center for CO_2 Science, experts on farming resource demands and CO_2's global interactions, concluded that the crop yield gains and water-use efficiencies that could be expected by 2050 were sufficient—but barely—to grow the food and feed that will be needed then on the lands we farm now, and with the water we currently use. Obviously, massive losses in habitat and biodiversity would inevitably result if large biofuel demands were to be imposed in addition to the surging demand for food and feed.[18]

Paul Josef Crutzen, of the Max Planck Institute for Chemistry in Germany, and co-authors warn, in an August 2007 study, that previous greenhouse gas studies had focused only on the conversion of crop biomass to biofuel, and thus ignored the use of fossil fuels to produce fertilizer and pesticides. Crutzen and his colleagues point out that the nitrous oxide (N_2O) gassed off by nitrogen fertilizer has a 100-year global warming potential 296 times larger than an equal mass of CO_2.[19]

Also in 2007, Corey J. A. Bradshaw of the University of Adelaide, in Australia, and his co-authors looked at the increased flood risks from expanded biofuels plantings. Their models indicated that a 10-percent reduction in natural forest area would increase flood frequency by 4 to 28 percent among the countries modeled, and that "unabated loss of forests may increase or exacerbate the number of flood-related disasters, negatively impact millions of poor people, and inflict trillions of dollars in damage in disadvantaged economies over the coming decades." China has already had to undertake reforestation on millions of acres in the Yangtze Valley for this very reason.[20]

Rich countries rushed into biofuels on a massive scale with little consideration of the costs in terms of radically higher food prices and rising emissions of greenhouse gases. Roger Revelle, who taught the Greenhouse Theory to his then-student Al Gore at Harvard, wrote just before his death in 1991 that global warming was a long-term problem "and we have time to do the science."[21] Let's make sure we do the science—all of it.

Coming Soon: Big Price Rises for Meat, Milk, and Eggs. Wheat prices have already been impacted by biofuel mandates. The U.S. Department of Agriculture warns that consumers are only beginning to feel the impact of corn that will remain "at historically high prices" for the foreseeable future.[22] Pork, beef, and poultry require several pounds of feed to produce one pound of high-quality protein. Meat, milk, and eggs are about to become much more expensive than we had believed possible. This will especially penalize the poor, who must spend up to two-thirds of their income on food.

The only country to rein in its biofuels program to date is China, which became frightened by its own food price inflation last year, and banned any further biofuel expansion. The only other major world leader willing to take on biofuels mandates is British Prime Minister Gordon Brown; British consumers are paying far more for food, and farmers far more for feed, than they did two years ago. Germany, France, and the United States are all in the same conflicted position, not wanting to take the lollypop from their farmers, but facing growing pressure from consumers as food prices soar.

Recently, I saw a plaintive note from a Midwest farmer noting that he has quietly asked his veterinarian for the best way to put down all his new piglets. He would incur a loss of $40 per head—bankrupting his family—if he grew them to market weight.[23]

What Is To Be Done? The world cannot possibly produce enough biofuels to make a significant difference in oil prices. Attempts to do so threaten the food security of the whole world, as well our biological heritage—the very plant and animal species that environmental activist groups claim they want to protect from the effects of global warming. And now we find that biofuels actually exacerbate the greenhouse effect. What excuse for biofuels is left?

How much longer will policy makers continue to pay farmers and rural bankers to invest even more heavily in biofuel programs that create food inflation, aggravate fuel costs, and increase greenhouse gas emissions? How many more farmers are buying land at

inflated prices, clearing woodlots, and draining wetlands, while their hopes will be dashed by congressional action that must come eventually? Waiting will only make everything worse. The biofuels mandates must be repealed, and the sooner the better.

Notes

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