The Oil Drum
DISCUSSIONS ABOUT ENERGY AND OUR FUTURE

Save it for the Combine

Posted by Jason Bradford on August 24, 2010 - 9:43am
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I have been visiting A2R Farms outside of Corvallis Oregon all year. They are a former conventional grass seed farm transitioning to organic seed crops, primarily for local distribution. I watched as they planted the fields and as the crops grew--flax, chick peas, sunflowers and wheat. And as harvest season approached I looked over at the combines and asked my friend Clinton Lindsey, "Which one am I driving?"

So I was delighted to get a call the other morning. Over the hum of a motor Clint told me, "Hey Jason, I'm harvesting the field north of our office today if you want to visit." Heck yeah! And I could bring the whole family. It was Saturday and we all would get a turn in the cab.

It is the middle of August and time to harvest wheat in the Willamette Valley of Oregon. Clint lets my 11 year old son Curtis steer a John Deere combine. Clint says newer equipment is faster, but more difficult to repair, so they stick with this model from the late 1980s.

Being aware of peak oil for several years now has given me time to consider what energy dense liquid fuels are extremely useful for. In an energy scarce world we will be resetting priorities. The question for the future is what do we *need* to do with energy rather than what do we *want* to do with energy.

In this post I will nominate my top pick. If I could wave a magic wand and reserve ample future supplies of petroleum (or some precious substitute such as a biofuel with high net energy) for just one use it would be the combine.

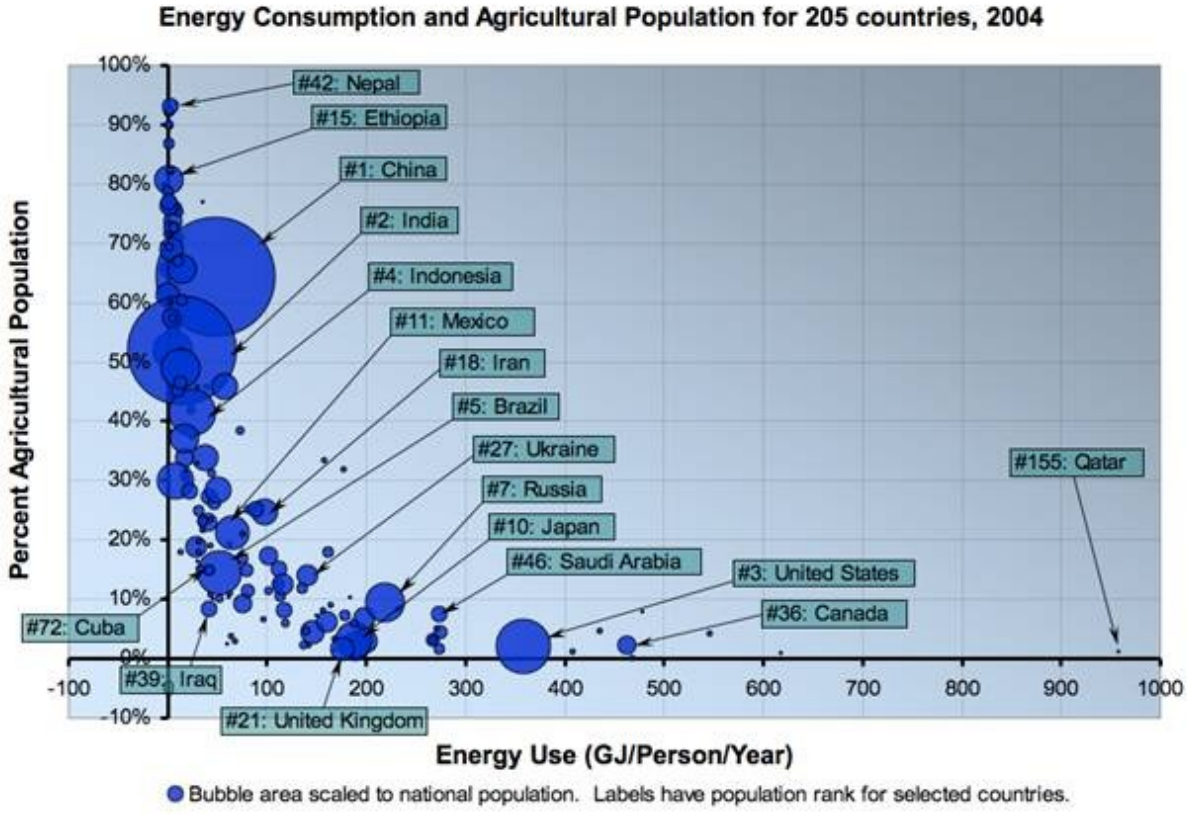
What it Does

The combine performs tasks that replace an enormous amount of labor in a reliable and timely fashion. It cuts the stalks of seed crops, threshes the heads to dislodge the seeds, and then separates the seeds from the straw and chaff. Without the combine (and a series of intermediate technologies), harvesting grains involves *manually* cutting stalks, bundling them, transporting the bundle to storage, threshing and winnowing.

The labor efficiency of the combine is extreme. Over the course of a long and somewhat boring 12 hour day in his air conditioned cab (made a little better by listening to audio books on an iPod), Clint can harvest about 25 acres of wheat. We visited while he was in a field with a hard red variety that yields about 2400 lbs per acre (soft white yields are 2-3 times higher). In one day, Clint and his machine will collect 60,000 lbs of hard red wheat, or 1000 bushels.

Each pound of wheat contains about 1500 food calories (i.e., kilo calories), and a person needs about 2500 calories per day. A year's supply of calories for a person is in the neighborhood of 900,000, which in wheat units is 600 lbs. In simple terms, during a day of work Clint can supply the annual food needs of 100 people. Of course he and his dad Mike also spent days prepping and sowing the field, and there are hours planning, maintaining equipment, and marketing, etc., but in total the amount of time actually spent with machines on that 25 acres is probably only a week or so. And since Clint and his family manage to farm several hundred acres it all works out to about 100 people fed by one guy like Clint, which is typical for the US food system.

I propose that the main enabler of a demographic shift away from rural-agrarian populations to an urban-industrial one is the combine. The combine removes most labor from agriculture for the most critical crops: edible grains, legumes and oil seeds. Seeds are a highly portable, storable and versatile class of food, allowing civilizations to trade and buffer against shortages. Most calories now consumed derive directly or indirectly from seeds.



The percent agriculture population is plotted in relation to per capita energy use. Nations with

abundant use of exosomatic energy tend to have less of their population involved in agricultural production, presumably either because they can afford to import much of their food or employ labor saving devices in food production. For example, only about 1% of the US labor force is involved in farming. Data comes from the Energy Information Administration (EIA) and the United Nations Food and Agricultural Organization (FAO). Original article containing figure is here.

The Hybrid Future

Looking at the above figure, it seems plausible that in the US we could do away with ¾ of our per capita energy and, if we allocate smartly, keep the combines running and continue to feed everybody with little extra labor (and assuming climate change doesn't bite too sharply into yields).

I do have mixed feelings about how the historical shift into cities and away from farms has impacted our culture. On the one hand, surplus food has permitted our society to specialize greatly, developing technologies, arts and forms of entertainment that I truly enjoy. Material abundance may also have led to cultural openness and flexibility, or what may be called liberalism, as opposed to the rigidity, isolation and xenophobia common to many pre-industrial societies.

On the other hand, I am certainly no fan of the over-consumptive lifestyles and the disconnection from nature endemic to highly industrialized cultures. However, one possible future entails a larger agrarian population as industrialized countries lose access to abundant fossil fuels. For example, even if we manage to save fuel for the combines, more labor will still be needed for plenty of other tasks. While this is likely to be a painful process, what could emerge is greater ecological awareness—the understanding that our livelihoods are deeply connected and dependent upon natural processes. Such a path is described in some detail by David Holmgren in Future Scenarios.

If energy descent extends over the next few-several decades (as argued by John Michael Greer) our economy will have hybrid characteristics—leveraging the value of existing infrastructure and machinery as long as possible while learning how to adapt to natural rhythms. Keeping such a transition as benign as feasible requires food supply stability. Maintaining social cohesion gives the population time to adjust to the new normal. Combines, I would argue, are a fantastic tool for obtaining surplus food. We should keep them running during any potential phase of "scarcity industrialism."

Energy Returned

Obviously, combines are entirely reliant on barrels and barrels of liquid fuel. Clint told me he uses about 50 gallons of fuel for every 8-9 hours harvesting wheat, which would cover about 17 acres. This means it takes around three gallons of diesel fuel per acre, just for the harvest. In standard energy terms three gallons of diesel contains 0.44 Giga Joules (GJ). For comparison, 2400 lbs of wheat contains just over 15 GJ of edible energy. Ignoring all the other energy needed to deliver the fuel to the farm, and get the crop to maturity, the harvest-only EROI is a highly profitable 34:1. (For a more thorough review of energy in the US food system see this post).

Liquid fuels are absolutely essential for industrial farming systems. I worry less about nitrogen fertilizer inputs, herbicides and pesticides, as these can be dramatically reduced using organic and agroecological methods. It is much more difficult to substantially decrease liquid fuel usage. Even with no-till methods, tractors make passes to sow seeds, and they make passes to harvest.

This is a picture of me scything grass between young orchard trees. I enjoy using the scythe and believe it is a valuable tool even on highly mechanized farms. I just wouldn't want to rely on it to harvest food for dozens of families. If we ever need scythes again to cut down our grain crops then most families will be feeding themselves.

Unless you relish the idea of your descendants living a life akin to Little House on the Prairie, it may be prudent to cut back a bit on oil consumption today and extend the reserves of fossil fuels as long as possible. Time is second to oil on my list of most precious resources. A slowing down today, when we have so much excess, potentially buys a lot of time for tomorrow. I don't know if we will use this time to develop liquid fuel substitutes for fossil fuels to run combines, or manufacture millions of scythes and train a whole generation to use them.