How Much Land Do We Need?

Contributed by Peter Goodchild
01 January 2010

Editor's note: In response to the Fortune magazine/CNN.com report on Detroit's urban farming trend, the author has provided some basics on crops and human needs. The original posting regarding "Can farming save Detroit?" is at the end of the author's remarks. - JL

The amount of land needed for farming with manual labor would depend on several factors: the type of soil, the climate, and the kinds of crops to be grown. The highest-yielding varieties are not necessarily the most disease-resistant, or the most suitable for the climate or the soil, or the easiest to store.

The weather also makes a big difference: too little rain can damage a crop, and too much rain can do the same. Unusually cold weather can damage some crops, and unusually hot weather can damage others. Without irrigation -- relying solely on rain -- the yield is less than if the crops were watered.

But here are some rough figures. Let us use the production of corn (maize) as the basis for our calculations, and for now let us pretend that someone is going to live entirely on maize. “Corn” or “maize” here does not mean the vegetable that is normally eaten as “corn on the cob,” but the types that are mainly used to produce cornmeal; these are sometimes referred to as “grain corn” or “field corn.” Corn is very high-yielding and can be grown easily with hand tools, but it is only practical in areas with long periods of warmth and sunshine; even in most parts of North America it is not easy to grow north of about latitude 45.

A hard-working adult (e.g., a farmer) burns about 5,000 kilocalories (“calories”) per day, or 2 million kilocalories per year. With non-mechanized agriculture, the yield of corn is about 2,000 kg/ha. The resulting food energy is about 7 million kcal/ha. Under such conditions, then, 0.5 ha of corn would support approximately 2 people. (The data can be found in David Pimentel’s many writings on this subject.)

Potatoes require about 50 percent less land than “grain-corn,” but they are troublesome in terms of insects and diseases. Wheat, on the other hand, requires approximately 50 percent more land than maize to produce the same amount of kilocalories. Beans require about 100 percent more land than corn. “Root crops” such as turnips, carrots, or beets have yields at least 10 times greater than corn, but they also have a much higher water content; their actual yield in kilocalories is slightly less than that of corn.

To determine whether a country can feed itself with manual labor, we need to look at the ratio of population to arable land. With manual labor, as noted, 0.5 ha of corn-producing land can support only 2 people. Any country with a larger ratio than that would be undergoing famine. The problem might be relieved to some extent by international aid, but without fossil fuels for transportation such international aid would be negligible. And this ratio is for corn, a high-yield crop; we are also assuming that crops will not be wasted by feeding them to livestock in large amounts.

In the early twenty-first century, according to the CIA World Factbook, the world as a whole has a population-to-arable ratio of 438 people per km2 (square kilometers). Conversely, less than half of the world’s 200-odd countries actually pass that test, and many of those are countries that have relatively low population density only because they have been ravaged by war or other forms of political turmoil. The Arabian Peninsula, most of eastern Asia, and most of the Pacific islands are far too crowded. Even the UK scores badly at 1,069:1. There might be serious conflicts between the haves and the have-nots, and isolationism might be a common response.

Further reading:

Pimentel, David, and Carl W. Hall, eds. Food and Energy Resources. Orlando, Florida: Academic Press, 1984.

----- and Marcia H. Pimentel. Food, Energy, and Society. 3rd ed. Boca Raton, Florida: CRC Press, 2007.

Growing Your Own Grains by Peter Goodchild, Culture Change

Can farming save Detroit?

(by Fortune and CNN.com, no less)

Commentary by Jan Lundberg

To: gwcc@lists.riseup.net; sfbayoil@yahoogroups.com

Subject: Can farming save Detroit? - Fortune and CNN.com

Date: Thu, 31 Dec 2009

Does the prospect of "the largest urban farm in the world" sound interesting? Read this surprising corporate-mainstream article about a financier named Hantz. Besides the Fortune mag glitz there's background that there are "900 urban gardens within the (Detroit) city limits. That's a twofold increase in two years... in a city that, incredibly, has no chain supermarkets".

Some of our concerns and efforts relating to peak oil, petrocollapse and climate distortion seem to independently grow out alongside others' slightly different community orientations, but it all leads to the same goal: sustainability. Hopefully, Hantz will learn about Permaculture soon, perhaps learning from Albert Bates at The Farm's Ecovillage Training Center (thefarm.org/ecovillages).

Pat Murphy and Megan Quinn Bachman of Community Solutions, maker of the film The Power of Community: How Cuba Survived Peak Oil, ought to be enlisted for interviews in national media outlets and at chambers of commerce to compare feasibilities in the U.S. with Cuba's urban farming (communitysolution.org). And Former HUD secretary Henry Cisneros, now chairman of CityView, a private equity firm that invests in urban development, quoted in the story as saying he's "in favor of 'other uses that engage human beings in their maintenance, such as urban agriculture'", should talk to Jason Bradford about his Vital Farmland initiative (farmlandlp.com).

As you may recall, Fortune featured billionaire peak oilist Richard Rainwater four years ago this week. He cited CultureChange.org as an established source for his awareness. (His citation is no longer on the online webpage)

For this fascinating story below there's a video too, and related articles, at the website.

- Jan Lundberg

Sail Transport Network / Pedal Power Produce

Culture Change

Portland, Ore.

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The Rainwater Prophecy, by Oliver Ryan, Dec. 26, 2005