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The local industrial complex? Questioning the link between local foods and energy use

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Abstract Local food has become the rising star of the sustainable agriculture movement, in part because of the energy efficiencies thought to be gained when food travels shorter distances. In this essay I critique four key assumptions that underlie this connection between local foods and energy. I then describe two competing conclusions implied by the critique. On the one hand, local food systems may need a more extensive and integrated transportation infrastructure to achieve sustainability. On the other hand, the production, transportation, and consumption of local foods are fundamentally as reliant on fossil fuels as are long distance foods. A more holistic approach to energy use in the food system is needed to determine which particular sociotechnical factors optimize energetic sustainability.

Keywords Energy · Fossil fuels · Industrialism · Local food systems · Sustainability

Introduction

Local foods have rapidly risen to the status of *cause célèbre* within the larger sustainable agriculture movement. They are eagerly discussed in numerous popular books, academic publications, and web sites. Loosely defined, the idea behind the movement is that purchasing one's food from nearby farmers creates a more resilient, equitable, and energy-efficient food system. "Local" is defined in various ways depending on geographic location, a common metric being a 100-mile radius from one's home.

According to the literature, there are many reasons for choosing a more local diet, including: the belief that local food is fresher; keeping money in the local economy; fostering closer relationships between producers and consumers; and creating a more equitable marketplace by rejecting the hegemony of the conventional food system. It is difficult to argue with the first three reasons, but recently there has appeared a set of articles taking a critical stance towards the fourth (see below). Coming mostly from branches of rural sociology and geography influenced by cultural studies, these critiques concern themselves less with the question of environmental sustainability and more with the overlooked issue of *social* sustainability.

Work on local foods and "embeddedness" has pointed out that a turn to the local does not necessarily herald a new wave of environmentally conscious consumer (Winter 2003), nor does it eliminate the economistic or "instrumentalist" nature of the relationship between buyer and seller (Hinrichs 2000). Dupuis and Goodman (2005) warn that the rise of movements such as local or Slow Food can foster a romanticized, apolitical stance that unreflexively frames localism as a social good. Patricia Allen and colleagues advance this argument by demonstrating how alternative movements including local food remain largely unattendant to issues of social justice (Allen et al. 2003; Allen 2004), particularly those related to farm labor conditions (Harrison this issue). Framing an issue strictly in terms of local effects and divorced from the larger sociopolitical context blinds observers to political machinations that uphold the status quo and perpetuate social inequalities (Hinrichs 2003; Harrison 2006).

A fifth and particularly important rationale for eating locally is that of energy efficiency and environmental

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sustainability: the fewer miles a food travels, the less fossil fuel it uses and the less it pollutes the atmosphere. With a few exceptions (e.g., Saunders et al. 2006; McWilliams 2007), this logic is widely accepted by both practitioners and observers of the movement. I will argue, however, that the reasoning which supports it is potentially flawed. If the studies above outline a *sociopolitical* fault line within the local food movement related to social justice and political awareness, my purpose is to concentrate on a more *technical* fault line, as the production, transportation, and consumption of local foods are no less reliant upon society's fossil-fueled industrial infrastructure than that of long distance foods. To paraphrase Hinrichs (2000, p. 301), we should be careful not to conflate spatial relations with ecological relations, for energetic sustainability is premised on far more than simply distance traveled.

Locality and sustainable energy use: four flawed assumptions

Though the link between intra-local trade and energy efficiency is widely assumed, the little empirical evidence in its favor is more suggestive than conclusive. The average piece of domestic produce now travels 1500 miles to reach its destination, an amount that has increased 25% since 1980 (Halweil 2002). Such a figure is derived using the "food miles" approach, a common methodological tool in food systems analysis (Pirog et al. 2001). In comparing locally grown products to those grown far away, a researcher calculates "the distance food travels from where it is grown to where it is ultimately purchased or consumed by the end user" (Pirog and Benjamin 2003, p. 1). The connection is then made, sometimes implicitly and sometimes explicitly, to the amount of fuel consumed on the respective voyages.

Though one of its chief practitioners is quick to point out that it is simply a conceptual tool and not a holistic measure of energy use (Pirog, personal communication), the local food movement's assertion of energetic efficiency rests largely on the results of food miles research. This assertion, however, is based on several flawed assumptions which, when exposed, lead us to question the sustainability of both long-distance *and* local food systems in the modern industrial economy.

First, the connection between a food system and energy use is usually made only in reference to the fuel consumed during transportation. Not taken into consideration are the energy embodied in the actual vehicles themselves (i.e., the energy bound up in steel, glass, plastic, and rubber); the immense energy expended to maintain the highway infrastructure; or the energy consumed by the human beings who labor all along the food transportation chain. It is not entirely clear at first glance whether incorporating this broader view of energy would prove a local or a long-distance food system more efficient. For example, a local system typically uses smaller vehicles and fewer total miles of road, but it also requires *more* vehicles traveling on *more* roads (e.g., many smaller farmers travelling from multiple locations to reach a farmers market). There are several methodological frameworks capable of accounting for this more holistic notion of energy use, such as the emergy approach (Odum 1996) and life cycle analysis (Keoleian and Heller 2004). In fact, a recent study using life cycle analysis revealed counter-intuitive results. For certain products such as milk, apples, and lamb, total CO_2 emissions per unit were less for products produced in New Zealand and shipped to the UK than for those produced in the UK itself (Saunders et al. 2006), although several of the assumptions underlying the study's methodology have been sharply criticized (Shuman 2007).

The second assumption concerns the volume of food transported by different vehicle types. Much local food advocacy is written as if economies of scale in food transportation are either nonexistent or unimportant. For a given voyage made by a shipment of vegetables, each vegetable is implied to have logged the full trip from farm to consumer. From an energetics point of view, however, each item would only account for a fraction of the total energy expended, equal to its portion of the load. This drawback makes the translation of food miles into explicit energy terms problematic.

Consider the following thought experiment: a truck carries 3000 tomatoes for 3000 miles from California to the east coast, using 500 gallons of fuel. If we focus only on distance, we would state that each tomato traveled 3000 miles, which is objectively true but obscures the effects of shipping large volumes. We can more accurately parse energy use *by item* and state that a single tomato only accounted for one-sixth gallon of fuel, or, strange as it may sound, the equivalent of one mile of transport.

This distinction becomes important when one considers the economies of scale achieved by modern long-distance transportation. A farmers market vendor may take a few hundred or a few thousand items to market, meaning that each item accounts for 0.5–0.05% of the energy used on the trip. By contrast, a fully-loaded semi trailer hauls over 38,000 items, meaning that each item accounts for 0.003% of the energy used—an order of magnitude less. This difference would be even more profound if long-distance food were transported by rail instead of highways. And while produce that comes from a different continent seems the most outlandish of long-distance foods, the vast majority of it travels by ship. A typical ocean-going cargo vessel can carry some 7,000,000 produce items on board, each one accounting for a nearly negligible 0.0000015% of the total energy used. In sum, the economies of scale of the

conventional food transport system may be sufficient to balance out the distances traveled, while the generally much smaller scale of local food transportation may actually cancel out the efficiencies gained by short travel distances (cf. Simons and Mason 2003).

The third assumption concerns the manner in which the consumer herself travels to purchase food. In the food miles literature, mileage is calculated from the point of departure to a generalized retail point—a grocery store or perhaps a farmers market. But this assumption ignores the fact that local food consumption may entail travel to farms themselves to purchase products directly from the farmers. Within fifteen miles of my own home, for example, are small operations variously selling meat, eggs, milk, butter, honey, and pickles directly from the farm, and anecdotal observations indicate that they do steady business.

The act of on-farm purchase embodies the idea of local consumption: one-on-one interactions with the farmer, profits passing directly to the farm, the freshness of the product, etc. But from the point of view of sustainable energy use, farm-direct sales present a catch-22. On the one hand, the food has not traveled more than a mile from where it was produced to where it is purchased, in comparison with the 20–50 miles from a farm to a farmers market, let alone the thousands of miles from California. On the other hand, the consumer must engage in the highly energy-intensive act of traveling to a farm to buy only a handful of products. This links to the earlier point about economies of scale: a few frozen chickens or a flat of strawberries account for far more energy per item when purchased on-farm than when purchased in a grocery store as part of a whole shopping list.

The fourth point is more an observation than an assumption: the local food movement is based entirely on the consumptive act. Local foods advocacy encourages consumers to *purchase* more food from local purveyors rather than, for example, producing it themselves. Yet it remains debatable whether a consumption trend can really have a system-wide societal effect (Gouveia and Juska 2002). The popular literature argues that buying local may help reverse the loss of small family farms (e.g., Food Routes Network n.d.), but there is little evidence to indicate that it actually has any effect on the structure of agriculture.

For example, even as demand for local food grows, it is just as likely that current direct-market farmers will scale up their operations as it is that new farmers will enter the market. The effects of such a trend are well illustrated by the darling of the local foods movement, Community Supported Agriculture (CSA), in which a consumer subscribes to a nearby farm for a weekly box of produce. CSA arrangements are growing in popularity throughout the country, and it is not atypical for a CSA farm to use multiple interns and have 50 to several hundred individual subscriptions (Lass et al. 2003). Hence we see a structural characteristic reminiscent of conventional agriculture's most aggravating boast: a single farm providing food for tens or even hundreds of families. If long-term environmental sustainability and the capacity to withstand ecological or economic perturbation are truly the goals, local food rhetoric should concentrate on increasing the number of people producing their own local food instead of consuming it. A rise in the number of urban and community gardens would go a longer way towards a sustainable and resilient agrifood system than an increase in the number of farmers markets, for it would diminish the presence of market relations in food consumption and shorten the distance between producer and consumer to the shortest possible path.

Can a modern local food system be environmentally sustainable?

There are two potential interpretations one could draw from the foregoing thoughts, which we might call the *soft critique* and the *hard critique* of local foods. The soft critique is that local food systems are a fundamentally sound idea that simply lacks a viable "local food infrastructure." Local food systems would benefit from a scaled-down version of the national food distribution system, geared towards moving large volumes of food with minimum loss to spoilage. Its economies of scale, if applied to a food system with a radius of only a few hundred miles, would be a tremendous improvement over the present local system marked by the transport of small quantities in cars, vans, and light trucks.

Interestingly, in one of the papers employing the food miles approach, Pirog et al. (2001) make precisely this point. They construct an empirical model which compares fuel use between three hypothetical food systems: a local system in which produce is transported by light-duty trucks, a national system such as the one currently in place, and a "regional system … that could supply retail, wholesale, and institutional markets. … [using] large semitrailer trucks and midsize trucks for transport." Their data show that the regional system would use the least fuel and emit the least pollution of the three.

The hard critique of local foods is not as forgiving. It argues simply that the modern industrial transportation system is *inherently unsustainable* given its dependence on fossil fuels. Consider the production of combustion engine vehicles alone: global sourcing of parts made from non-renewable materials; production in massive, energy-consuming plants; and an end product that runs on fossil fuels and is shipped to its destination on the trailers of even less efficient trucks. Despite the intuitive appeal of a

farmers market, each vendor there relies on some such vehicle to transport her products, just as she likely relies on a tractor to cultivate her fields back on the farm. And the local food consumer drives the same kind of vehicle as the conventional consumer and requires just as many if not more miles of asphalt and gallons of fuel to complete his shopping trip. From this point of view local foods present only a "superficial resilience" (Worosz et al. this issue), for their mere localness does not lessen their reliance on the vast, fossil-fueled matrix of production and locomotion which envelops the economy of the industrialized world.

Regardless of which position one adopts, a more fundamental conclusion is that food systems cannot be evaluated without taking into account the larger socio-technical context in which they exist. My argument has been that local food systems remain embedded in the same environmentally unsustainable industrial infrastructure as long distance foods, but the fault(line) lies with industrialism itself, not simply the food system. In a more ecologically conscious social environment, localness of food will matter a great deal. The deterioration of industrial agriculture, the rising cost of refrigeration required for storage and transport, and the increased use of biofuels may tip the energetic balance unequivocally back in favor of local foods. More prosaically, even if home or urban garden production increases as I have advocated, it will always exist in combination with consumption. The question, then, is not which food system is de facto more environmentally sustainable, but which combinations of factors may achieve optimal energy efficiency and sustainability in the near future.

This opens up space for food scholars and activists to devise new models that explore a wide variety of variables. Some I have already hinted at: increased use of biofuels in vehicles; increased use of railways to transport food; or a distribution company picking up produce at individual farms and bringing it to a central location rather than each farmer traveling individually. Others might include: local stores specializing in products from a given region; large supermarkets stocking more local items; or the energy consequences of canning and other forms of food preservation. Each of these approaches can be modeled using one of the more holistic forms of energy measurement mentioned above. Once we move from taking the environmental superiority of local foods for granted to analyzing the circumstances which differentially impact efficiency, we can pair this with our concepts of social equitability to arrive at a more holistic understanding of what is a sustainable food system in the widest sense.

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References

Allen, P. 2004. *Together at the table: Sustainability and sustenance in the American agrifood system*. University Park, PA: Pennsylvania State University Press.

Allen, P., M. FitzSimmons, M. Goodman, and K. Warner. 2003. Shifting plates in the agrifood landscape: the tectonics of alternative agrifood initiatives in California. *Journal of Rural Studies* 19: 61–75.

DuPuis, E.M., and D. Goodman. 2005. Should we go ''home'' to eat?: Toward a reflexive politics of localism. *Journal of Rural Studies* 21: 359–371.

Food Routes Network. No date. Where does your food come from? Plant your dollars close to home and watch your community grow. http://www.foodroutes.org/doclib/140/EconomyColor11.20.pdf. Accessed 26 June 2007.

Gouveia, L., and A. Juska. 2002. Taming nature, taming workers: Constructing the separation between meat consumption and meat production in the US. *Sociologia Ruralis* 42 (4): 370–390.

Halweil, B. 2002. *Home grown: The case for local food in a global market. Worldwatch Paper 163*. Washington, DC: Worldwatch Institute.

Hinrichs, C. 2000. Embeddedness and local food systems: Notes on two types of direct agricultural markets. *Journal of Rural Studies* 16 (3): 295–303.

Hinrichs, C. 2003. The practice and politics of food system localization. *Journal of Rural Studies* 19 (1): 33–45.

Keoleian, G.A., and M.C. Heller. 2004. Life cycle-based sustainability indicators for assessment of the U.S. food system. In Proceedings from *life cycle assessment in the agri-food sector*, ed. N. Halberg, 190–198. Bygholm, Denmark: Danish Institute of Agricultural Sciences.

Lass, D., G.W. Stevenson, J. Hendrickson, and K. Ruhf. 2003. *CSA across the nation: Findings from the 1999 CSA survey*. Madison, WI: Center for Integrated Agricultural Systems.

McWilliams, J.E. 2007. Food that travels well. *New York Times*. August 6.

Odum, H.T. 1996. *Environmental accounting, energy and environmental decision making*. New York: Wiley.

Pirog, R., T.V. Pelt, K. Enshayan, and E. Cook. 2001. *Food, fuel, and freeways: An Iowa perspective on how far food travels, fuel usage, and greenhouse gas emissions*. Ames, IA: Leopold Center for Sustainable Agriculture.

Pirog, R., and A. Benjamin. 2003. *Checking the food odometer: Comparing food miles for local versus conventional produce sales to Iowa institutions*. Ames, IA: Leopold Center for Sustainable Agriculture.

Saunders, C., A. Barber, and G. Taylor. 2006. *Food miles: Comparative energy/emissions performance of New Zealand's agriculture industry*. Research Report 285. Lincoln, New Zealand: Agribusiness & Economics Research Unit, Lincoln University.

Shuman, M. 2007. On the lamb. http://www.ethicurean.com/2007/08/10/shuman-on-lamb/#more-2270. Accessed 12 September 2007.

Simons, D., and R. Mason. (2003). Lean and green: 'Doing more with less.' *ECR Journal* 3 (1): 84–91.

Winter, M. 2003. Embeddedness, the new food economy and defensive localism. *Journal of Rural Studies* 19 (1): 23–32.

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