

## Decentralized Production and Affective Economies: Theorizing the Ecological Implications of Localism

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**ABSTRACT** In this paper I examine the contemporary trend toward de-industrialized and decentralized production with a view to its implications for ecological sustainability. Specifically, I suggest we can understand the potential positive ecological implications of such trends by reconceptualizing “incomplete information” in markets, which is often understood as a key way in which markets fail to solve or forestall environmental problems. One promising aspect of decentralized production is its ability to facilitate greater flows of “information” in the market, as consumers bring themselves into closer proximity to production processes. However, posing the problem and the promise of different regimes of production in terms of information assumes fixed preferences and desires on the part of individual consumers and producers, and it ascribes to the non-human components of the production process only the potential to meet preexisting human desires. I argue for expanding the logic of “information problems” to consider how affects as well as information flow alongside materialities in cycles of production and consumption. Rather than seeing consumer “preferences” as desires inherent in individuals, I claim we should understand affects—including different modes of acquisitiveness as well as ecological and social sensibilities—as the emergent properties of specific assemblages of humans and non-humans that comprise and perform processes of production, distribution, and consumption. To help explicate this claim I first explore the ecological implications of the local food movement, and a specific attempt to capitalize on emerging technologies to decentralize production: Marcin Jakubowski’s Open Source Ecology project.

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A convergence of several factors is driving a growing trend toward decentralized production of goods. In the developed world this trend is manifested in several social movements and subcultural currents, such as the DIY and makers movements, peer-to-peer production initiatives, open-source ideology, and the local food movement. This general trend can be accounted for in several ways. It is in part an expression of political ideology—specifically, of a localism responding to concerns about the environmental costs, economic dangers, and cultural dislocations of global capitalism. Production decentralization is also enabled by concrete economic factors. In postindustrial societies such as the United States, a sort of productive vacuum has been created as whole industries have absconded, leaving abandoned warehouses, unemployed workers, and urban blight behind them. As ground rents hit bottom in places like Baltimore and Detroit, urban brown-fields and abandoned industrial sites are turning into boutique manufactories, hacker spaces, makers’ collectives, and urban farms.

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These economic and political forces of production decentralization have been aided by technological developments. The past three decades have seen not only the total transformation of communication via the internet, but also the comparatively slow rollout of nonetheless potentially transformative manufacturing technologies based on computer numerical controlled (CNC) machining and additive manufacturing, popularly known as 3D printing.

These technological developments have been heralded by futurologists as fundamentally transformative of capitalism. Jeremy Rifkin sees the information age as ushering in the “third industrial revolution.”<sup>1</sup> Others have announced the advent of the fifth “techno-economic paradigm” of capitalism.<sup>2</sup> Still others proclaim the end of capitalism altogether and the emergence of dispersed local economies of commons-based peer production.<sup>3</sup> Such speculation often takes for granted the ecological benefits of the production decentralization trend. Thanks in large part to the rhetoric of the local food movement, the term “local” has become almost synonymous with ecological virtue. Social entrepreneurs touting local, distributed production almost invariably deploy the watchwords of sustainability and ecology. But a note of caution is needed here. Is production decentralization really a force for sustainability? The aim of this article is to think through this question in a way that synthesizes the insights of economists, interdisciplinary political ecologists, literary eco-critics, and humanities-oriented social theorists.

To the extent that questions of sustainability and production decentralization have been taken up for serious analysis, the analysis has largely been confined to food production. Moreover, the question of the sustainability benefits of local food has been debated almost solely in the rather narrow terms of “food miles” and energy efficiency.<sup>4</sup> In these terms, the latest studies show it is not at all clear that local is necessarily sustainable. The first section of this article explores this debate. Detractors note that the logics of economies of scale and comparative advantage suggest that radically decentralized production could very well be more energy intensive, and thus less sustainable, than globalized trade networks. In this section I suggest that we must broaden this conversation to consider ecological sustainability in a way that is not limited to calculating the carbon footprints of various production and distribution processes.<sup>5</sup> In order to understand the potential positive ecological implications of production

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<sup>1</sup> Jeremy Rifkin, *The Third Industrial Revolution* (New York: Palgrave MacMillan 2013).

<sup>2</sup> Vasilis Kostakis, “At the Turning Point of the Current Techno-Economic Paradigm: Commons-Based Peer Production, Desktop Manufacturing and the Role of Civil Society in the Perezian Framework,” *Triple C* 11, no. 1 (2013): 173-190.

<sup>3</sup> Jacob Rigi, “The Coming Revolution of Peer Production and Revolutionary Cooperatives: A Response to Michel Bauwens, Vasilis Kostakis and Stefan Meretz,” *Triple C* 12, no. 1 (2014): 390-404.

<sup>4</sup> For example, see Stephen Martinez et al., “Local Food Systems: Concepts, Impacts, and Issues,” USDA Economic Research Report No. (ERR-97) May (2010).

<sup>5</sup> In referring to “sustainability” and “the question of sustainability” I mean first and foremost to refer to the ecological viability of the human economy as a system nested within the metabolic dynamics of the global ecosystem. I accept the premise of ecological economics that the current economic system in which economic “health” is premised on exponential GDP growth is not sustainable in this sense. While I would argue that the big-picture question of the ecological (and ultimately, thermodynamic) viability of the growth economy is a necessary ground for conceptualizing sustainability, I hasten to

decentralization, I suggest that it is helpful to depart from the well-studied problem of “incomplete information” in markets, which has been understood as one key way in which markets fail to forestall environmental problems, and is thus a key target of environmental public policy. Indeed, advocates of local food production suggest that a primary benefit of decentralized production is increased awareness, as consumers bring themselves into closer proximity to production processes, sometimes participating significantly in the production of many of the goods they consume.

Put in the language of economists, the claim is that production localization can facilitate greater flows of “information” in markets and thus can help alleviate the information asymmetries that may conceal environmental abuses. However, in the second section I argue that there is danger in parsing the ecological problems and promise of different regimes of production within the economist’s language of “information.” Such a framing lends itself to the assumption that individuals have fixed preferences and desires, and it ascribes to the non-human components of the production process only the potential to meet pre-existing human desires. Here I will argue that in our discussions of sustainable economies, we should expand the logic of “information problems” to consider how not only information, but also desires, sensibilities, and attachments emerge and flow within material cycles of production and consumption. Moreover, rather than seeing the affects that fuel market dynamics as preferences and desires inherent in individuals, I claim that we should understand such affects—including different modes of acquisitiveness as well as ecological and social sensibilities—as the emergent properties of specific assemblages of humans and non-humans that comprise and perform processes of production, distribution, and consumption. In the third section of the article, I flesh out this argument by exploring a contemporary scheme aimed at jump starting a radical redistribution of the means of production in non-food sectors: Marcin Jakubowski’s Open Source Ecology project. In the final section, I argue that this theoretical work makes space for synergy among several different viewpoints within environmental political thought, including eco-Marxism, green consumerism, and radical localism.

### Is Local Green?

Perhaps the most widely read and extensive rejoinder to the presumed ecological benefits of decentralized, or “local” production has been Desrocher and Shimizu’s *The Locavore’s Dilemma: In Praise of the 10,000 Mile Diet*.<sup>6</sup> The book contains a sustained counter-argument

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point out that it is not a sufficient ground. Without attending to the social, political, and historical dimensions of environmental problems our efforts to understand and achieve a “sustainable” society will fail. In many cases, production decentralization, particularly in the food sector, is part and parcel of struggles for autonomy, including post-colonial struggles (as in the Bougainville Revolution) and struggles for gender equality (as with the Green Belt Movement in Eastern Africa). In this article, I bracket some of these important social and cultural implications of production decentralization to focus on developing a theoretical framework that is legible from the standpoint of economic analysis and which emphasizes the creative influence of non-human agencies within the social/economic realm. My wager in doing so is that it can be useful to theorize the ecological-ethical implications separately from other dimensions of the politics of production, even and especially when the goal is to then integrate these distinct critical logics within larger counter-hegemonic political struggles.

<sup>6</sup> Pierre Desrocher and Hiroko Shimizu, *The Locavore’s Dilemma: In Praise of the 10,000 Mile Diet* (Public Affairs: New York, 2012).

based largely on the notion that, at least in the food sector, economies of scale and comparative advantage make the global industrial model of production far more energy efficient than one might immediately think, and local production potentially less efficient by comparison. The most compelling part of Desrocher and Shimizu's book is their articulation of the so-called "food miles fallacy," or the argument that comparative advantage and economies of scale make "food miles" a misleading indicator of carbon intensity and global warming contribution. Transport by sea and rail, in particular, are orders of magnitude more efficient in terms of fuel per mile per ton of freight than transporting food by pickup truck. Calorie for calorie, the 30 mile drive from the farm to the table may produce more green house gasses (GHGs) than delivery of the same food through a global supply chain to your nearest Walmart. Many other critics have made much the same point as Desrocher and Shimizu, but *The Locavore's Dilemma* stepped up the criticism by claiming that misled locavores are not only not helping things, but are actually making environmental problems worse by abandoning the efficiencies of existing industrial systems.

The most comprehensive studies of the carbon footprints of local and non-local food production/distribution tell a more nuanced story. Recent research by Avetisyan, Hertel, and Sampson shows widely varying results depending on which foods, regions, growing methods, and modes of transportation are assumed.<sup>7</sup> Flying green beans from Kenya instead of growing them in the UK is a common practice that, as they show, certainly does not make carbon sense. Shipping apples from Brazil, however, on their analysis produces less CO<sub>2</sub> than refrigerating UK-grown bushels through the year. There is one simple point that all such studies agree on, however: how far food travels is relatively insignificant in terms of reducing food related GHG emissions. Most of the carbon footprint of food comes from on-farm production and food preparation in factories and kitchens. Thus, for example, a 2008 study by Weber and Matthews, which used input-output life-cycle analysis to compare energy costs of transporting a wide array of foods, concluded that "buying local" could theoretically "achieve, at maximum, around 4-5% reduction in (food-related) GHG emissions."<sup>8</sup>

Numbers like these suggest a hard-nosed critique of the received wisdom about local food. But committed localists typically respond with the contention that buying local food is about much more than ameliorating global warming.<sup>9</sup> Some may voice a desire to preserve farmland and help farmers succeed in their communities. Others may cite the cruel treatment of animals on factory farms, or health and safety concerns, and the specter of invisible harmful "chemicals" in conventionally produced foods. Still others hold up the ideals of "food democracy" or "food sovereignty"—the empowerment of individuals or communities that may come with being more involved in producing one's own food and building "social capital" through local food systems. Such disparate rejoinders may seem to dodge the issue. However,

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<sup>7</sup> Misak Avetisyan, Thomas Hertel, and Gregory Sampson, "Is Local Food More Environmentally Friendly? The Global GHG Emissions Impacts of Consuming Imported vs. Domestically Produced Food," *Environmental and Resource Economics* 58, no 3 (2013): 415-462.

<sup>8</sup> Christopher L. Weber, and H. Scott Matthews "Food-Miles and the Relative Climate Impacts of Food Choices in the United States." *Environmental Science and Technology* 42, no. 10 (2008): 3512.

<sup>9</sup> Grist, 2010 website, accessed 4 August 2014. <http://grist.org/article/food-fight-do-locavores-really-need-math-lessons/full/>.

defenders of local food movements tend to focus on the larger whole out of which such individual “issues” are abstracted. Laura Delind, a scholar of contemporary food movements, articulates the overarching logic of the local food movement as one of *re-contextualization*,<sup>10</sup> citing specifically Kenneth Dahlberg’s call for a “contextual analysis” of “complete food systems.”<sup>11</sup> By this logic, narrow focus on carbon footprint analysis is all too similar to the kind of narrowly economic thinking that created the now globalized industrial food system and all of its problems. A contextual approach to thinking about food would not mean ignoring carbon footprint analyses, but attending to them as just one element of a larger conversation about the complex interconnections between social, environmental, economic, and political issues. However, there are also dangers that must be avoided as we pursue the contextual analysis that Dahlberg rightly calls for. If we try to think everything all at once, devilish details such as the food-miles fallacy can be missed. In thinking through the implications of decentralized production, we need to avoid both the pettifogging of reductive logic and the potential blindnesses that result when holistic critiques descend into vague ideologies.

Toward this end, I suggest that an important first step in re-contextualizing the food miles debate, with its dominant focus on comparative advantage and economies of scale, is to complicate it with a critical reconceptualization of another concept familiar to economists: that of “information asymmetries.” Although they do not use economists’ language of “asymmetrical information,” many leading critics in the local food movement have nonetheless argued, implicitly if not explicitly, that a primary rationale for buying local is solving information problems in the marketplace. Michael Pollan, for example, makes much of the problem of incomplete information in industrial supply chains. “A wall of ignorance intervenes between consumers and producers,” he writes, “and that wall fosters a certain carelessness on both sides. Farmers can lose sight of the fact that they’re growing food for actual eaters rather than for middlemen, and consumers can easily forget that growing food takes care and hard work.”<sup>12</sup> The answer, for Pollan, is to buy directly from a local farmer: “shake the hand that feeds you.”<sup>13</sup> This way, “If you’re concerned about chemicals in your produce, you can simply ask the farmer at the market how he or she deals with pests and fertility and begin the sort of conversation between producers and consumers that, in the end, is the best guarantee of quality in your food.”<sup>14</sup> Through direct market interactions, Pollan argues, “eaters can make their needs and desires known to the farmer, and farmers can impress on eaters the distinctions between ordinary and exceptional food, and the many reasons why exceptional food is worth what it costs. Food reclaims its story ... when the person who grew it hands it to you.”<sup>15</sup> Vandana Shiva, a leading proponent of “food sovereignty” for traditional agricultural communities, makes much the same point about the mustard oil industry in India. Traditionally,

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<sup>10</sup> Laura B. Delind, “Are Local Food and the Local Food Movement Taking us Where we Want to Go? Or are we Hitching our Wagons to the Wrong Stars?” *Agriculture and Human Values* 28, no. 2 (2007): 273-283.

<sup>11</sup> Kenneth Dahlberg, “Regenerative Food Systems: Broadening the Scope and Agenda of Sustainability,” in *Food for the Future*, ed. P. Allen (New York: Wiley, 1993), 75-102.

<sup>12</sup> Michael Pollan, *In Defense of Food* (London: Penguin, 2008), 162.

<sup>13</sup> *Ibid.*, 160.

<sup>14</sup> *Ibid.*, 159.

<sup>15</sup> *Ibid.*, 160.

Shiva writes, “[women] would buy small quantities of mustard oil extracted on their local *ghani* [oil press] in front of their eyes. This direct community supervision over the processing of food is the best guarantee of food safety.”<sup>16</sup> The same logic holds for environmental concerns. If I shake the hand that presses my mustard oil, then I should be better able to know if it was pressed in an environmentally harmful way. If I am concerned about chemicals in the waterways, “I can simply ask,” as Pollan suggests.

This logic is applied specifically to environmental concerns in the rhetoric of many local food activists and organizations. The Appalachian Sustainable Agriculture Project (ASAP), a prominent local food initiative in the Southeastern United States, for example, bases their work on an explicit “theory of food system change”: namely, that “localizing food systems strengthens local economies, boosts farm profitability, increases sustainable production practices, and improves individual and public health.” “This theory,” they go on to explain, “is grounded in ASAP’s conviction that when the distance between consumer and producer decreases, transparency in the food system increases” (ASAP 2014). The San Francisco-based “Locavores” organization lays out a similar logic of knowledge, information, and transparency.

What is eaten by the great majority of North Americans comes from a global everywhere, yet from nowhere that we know in particular ... If the production, processing, and transport of what we eat is destructive of the land and of human community—as it very often is—how can we understand the implications of our own participation in the global food system when those processes are located elsewhere and so are obscured from us? How can we act responsibly and effectively for change if we do not understand how the food system works and our own role within it?<sup>17</sup>

A food writer for Seattle-based *Grist* magazine presents the same ideas using the language of trust:

Bringing eaters and farmers closer together allows the formation of trust. When eaters can see the benefits of good agricultural practices in their backyards, they are more likely to support those practices. People are less likely to buy cheap food that relies on nasty polluting externalities if they can actually see that pollution in their creek. We’re all more likely to make sane choices about food when we are connected to our farmers.<sup>18</sup>

We may debate these claims, but at the very least it seems clear that the local food movement, even if some of its assumptions may be mistaken, has generated a conversation about where our food comes from, and thus has circulated a good deal of “information” about the environmental effects of food production.

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<sup>16</sup> Vandana Shiva, *Stolen Harvest* (Cambridge, MA: South End Press, 2000), 23.

<sup>17</sup> Locavores website, accessed 4 August 2014, <http://www.locavores.com>.

<sup>18</sup> Nathaniel Johnson, “All Food Politics is Local: What’s Next for the Sustainable Food Movement?” (Grist website, 28 January 2014), accessed 4 August 2014, <http://grist.org/food/all-food-politics-is-local-whats-next-for-the-sustainable-food-movement/>.

### Information, Affects, and Sustainability

If increasing transparency and providing nuanced information is touted as a crucial ecological benefit of local production, it should be noted that localization is not the only strategy for solving information problems. The idea that solving information problems is crucial to making production sustainable is not new; it has been the rationale behind eco-labeling schemes such as the Nordic Ecolabel, the Carbon Trust's "Reducing CO<sub>2</sub>" label, the Marine Stewardship Council's "sustainably sourced" seafood label, the Forest Stewardship Council's "sustainable timber" label, and numerous others. The prevalence of ecolabels has been steadily increasing over the last several decades, and enthusiasm for them has grown in global environmental policy circles. Almost 20 years ago ecolabeling was already being hailed as the "third wave" in pollution control, following statutory controls and market incentives.<sup>19</sup> New digital technologies such as barcode scanning apps for smartphones show that the possibilities of eco-labeling have not been exhausted.<sup>20</sup>

Because eco-labeling regimes have been the focus of many political and legal battles, their effects on the behavior of consumers and producers have been studied extensively. What has received far less attention is how localized production might function to accomplish much the same balancing of asymmetric information, even though, as we have seen, this function is considered quite important within the local food movement.<sup>21</sup> Indeed, it would seem that this should be attended to especially because when the energy inefficiencies and comparative disadvantages of small-scale local production are considered, the transparency of proximity may be where the ecological value of decentralized food production actually lies.

However, while viewing the ecological implications of production decentralization through the lens of solving information problems can help move debates about local production away from a myopic focus on supply-side carbon efficiencies, the usefulness of this concept for understanding the implications of the movement toward decentralized production is ultimately too limited, and the conversation needs to be broadened further still. If we take solving information problems to be paramount to "greening" production and consumption, we are assuming the traditional model of economic phenomena wherein human agents carry their preferences—whether strictly pecuniary, ecologically ethical, or otherwise—into the market and use available information to make choices more or less rationally calculated to fulfill those preferences.

This is essentially the familiar game theory, "rational choice" model of mainstream economics, the oversights of which have been subject to much criticism both within and outside the field. Rehashing those criticisms in detail is beyond the scope of this article;

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<sup>19</sup> See Tom Tietenberg, "Disclosure Strategies for Pollution Control," *Environmental and Resource Economics* 11, no. 3 (1998): 587–602.

<sup>20</sup> With the Goodguide app, for example, finding out how green a product is purportedly now as simple as photographing the barcode.

<sup>21</sup> Slightly more common in public policy scholarship, very ironically, are discussions of "local-washing," and the information problems that may arise as an increasing number of brands co-opt the ill-defined "local" label. See, for example, McRae et al., "Empowering the Citizen-Consumer: Re-Regulating Consumer Information to Support the Transition to Sustainable and Health Promoting Food Systems in Canada," *Sustainability* 4, no. 9 (2012): 2146–2175. If transparency and information is the real environmental benefit of buying local, the ecologically pertinent "information" provided by a label that reads "locally produced" is, strictly speaking, nil.

however, one significant current of critique is worth pointing out: the so-called constructivist turn within the social sciences, sometimes termed the “ideational turn” or “reflectivism.” Constructivists express deep skepticism about economists’ conventional modes of inquiry, in which, as Timothy Luke observes, “individual utilities, tastes, or preferences are entered into the choice-theoretic model as existing facts.”<sup>22</sup> Meanwhile, “Little or no effort is expended on explaining the processes of preference formation ... Consequently the collective cultural, political, and social values that historically constitute these individual preferences are, to a large extent, deculturalized, dehistoricized, depoliticized, and desocialized.”<sup>23</sup> The major corrective to the rational choice model that has emerged from the ideational turn is the notion that the *evolution* of values, the *formation* of preferences, and even the social *construction* of “material” interests must be understood as integral and endogenous to any meaningful model of economic behavior.

The constructivist perspective suggests that much of the action happens before or behind supposedly given “preferences,” and within or between the human minds that prefer them. However, in my estimation, constructivism is prone to its own oversights. It has tended to overemphasize ideational, linguistic, and mental factors in the “social production” of preferences, interests, and values. It did this for good reason: constructivism was a response to a brand of materialism that took certain “preferences”—“material interests”—to be strictly determined by the physical real. However, in their zeal to dethrone this version of materialism, many constructivists glossed over the indeterminate but nonetheless meaningful ways in which materiality participates in the social world. Pointing out this oversight within the otherwise productive constructivist critique has been one of the motivations behind a parallel movement within social theory towards a “new materialism,” which, in the version I find most helpful, blends the Deleuzian concept of “assemblage” with Latour’s notion of “actor networks.”<sup>24</sup> This renewed emphasis on the role of materiality in political and economic life differs from “old” materialism in that it does not try to understand human subjects as predictable, mechanistic material agents by assuming bounded rational selves with given interests; rather, it includes the material world in a model of “dispersed agency,” wherein the drivers of spontaneous (and difficult to predict) human behavior are not entirely within the human compass but inhere in the broader material assemblages of human and non-human bodies that constitute the social world. The central theoretical project here is, paraphrasing Latour, to “reassemble the social.”<sup>25</sup>

Like constructivism, the new materialist conceptual framework yields theoretical insights and creative perspectives, but not the kind of scientific certainties hoped for by some proponents of formal modeling. It may point us to new ways of looking at the human world—ways that show that it is, importantly, an always more-than-human world—but it comes with

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<sup>22</sup> Timothy W. Luke, “Reason and Rationality in Rational Choice Theory,” *Social Research* 52, no. 1 (1985): 70.

<sup>23</sup> *Ibid.*, 70.

<sup>24</sup> See especially Jane Bennett, *Vibrant Matter: The Political Life of Things* (Durham, NC: Duke, 2010); Bruno Latour, *Reassembling the Social: An Introduction to Actor Network Theory* (Oxford, UK: Oxford, 2007); and Bruce Braun, and Sarah J. Whatmore eds., *Political Matter: Technoscience, Democracy, and Public Life* (Minneapolis: Minnesota, 2010).

<sup>25</sup> Latour, *Reassembling the Social*.



the caveat that we very often will not be able to make the kind of truth claims that enable us to predict and control the social world in any robust sense. Such an approach therefore entails a chastened view of what “social science” is ultimately for. One thing this approach can do, however, is to allow us to understand that the implications of decentralized production may go well beyond the logic of transparency and the balancing of information asymmetries. If “preferences” are not merely given but instead are largely socially constructed, and if this social construction takes place within a social nexus that includes not just people and their minds but also a host of nonhuman bodies, artifacts, materials, and sites, then different modalities of production and consumption become important for more than their ability to convey information and fulfill preferences. The materials, means, and modes of production must also be seen as participants in assemblages out of which the “preferences” and affects that drive economic activity emerge.

The new materialist theoretical framework has not been explicitly applied to the economics of sustainability, but this framework can be helpful in extending some promising insights emerging in this field, particularly those coming out of a body of scholarship currently developing around “sustainability transitions.” In a recent study, Seyfang, Longhurst, Haxeltine, and Hargreaves argue persuasively that the social factor is precisely what is missing from contemporary research on sustainability movements. In their words:

Societal agency is regularly reduced to the aggregated outcomes of the more or less rational choices and actions taken by individual consumers, or “end users,” revealing their preferences in a particular market. In such models, a fundamental part of any transition pathway thus rests on informing or persuading these individuals to choose more sustainable (e.g. “lower-carbon-footprint”) forms of behavior, and in enabling such choices by removing various barriers to their realization.<sup>26</sup>

Information asymmetry is one such barrier, along with what are often the higher costs of sustainably produced goods and services. However, while removing barriers and structuring incentives are laudable and needed strategies, the authors suggest we should not stop here. They find that “the sustainability transitions literature has hitherto largely neglected demand-side factors such as lifestyles, social practices and co-evolutionary formulations of normal consumption, and has neither adequately conceptualized nor understood the role for civil society in contemporary transition processes.”<sup>27</sup> Using the UK’s “transition towns” movement, which specifically advocates decentralized production and localized economies, as a case study, the authors argue that it is insufficient to look at changes in production practices and the development of more energy efficient technologies in isolation from the social movements they may or may not be involved with, which may drive sustainability not just through technological innovation and political pressure, but also by creating new cultural norms of consumption.

I am in agreement with Seyfang *et al.* and with others who have insisted on the role of cultural factors and social movements in powering the hoped-for transition to more sustainable

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<sup>26</sup> Gill Seyfang, Alex Haxeltine, Tom Hargreaves, and Noel Longhurst, “Energy and Communities in Transition: Towards a New Research Agenda on Agency and Civil Society in Sustainability Transitions,” *CSERGE working paper EDM No. 10-13* (2010): 4.

<sup>27</sup> *Ibid.*, 3.

economies. However, social movements such as the “transition towns” movement, the local food movement, and the more general movement toward decentralized production will be better understood if the “social” is consciously expanded to include the materials, organisms, machines, and places that collaborate with (or obstruct) humans in moving these movements. The local food movement is made up not just of farmers and eaters and the new ideas they are generating, but also of the wider material assemblages in which food is made, exchanged, and consumed. This wider context includes farms that are smaller in scale and more diversified than the single-commodity farms predominant in the industry, farmers markets where eaters meet growers, and the wide variety of cultivated plants and domestic animals that are being revived from agricultural obsolescence.

Within this alternative economic landscape, information is produced and circulated in different ways, but perhaps more crucially, affects also emerge, intensify, and flow in different ways. Seasonality is one example. Barbara Kingsolver’s popular book *Animal Vegetable Miracle* is devoted to the pleasures of eating in season, which she feels “helps move ‘eating’ in the consumer’s mind from the Routine Maintenance Department over to the Division of Recreation.”<sup>28</sup> Eating in season means sacrificing some convenience, but at least for some it also means re-coupling the pleasures of taste and nourishment to the yearly cycles of the natural world, opening up new ways of experiencing and appreciating both food and the passing seasons. Similarly, advocates of eating locally attest that reintegrating production and consumption at smaller geographical scales can also be a way of integrating the sense of taste and the rituals of sustenance into a sense of place. Advocates like Bill McKibben attribute to food an extraordinary power to make or remake the connections that forge a deep sense of place. The language of information and knowledge is interwoven with that of affects and desires in McKibben’s account of how his “year of eating locally” served to involve him intimately in a social network that includes people but ultimately also extends to the plants, animals, soils, architectures, technologies, and geophysical formations of his central Vermont community. McKibben concludes:

I’ve had to think about every meal, instead of wandering through the world on autopilot, ingesting random calories. I’ve had to pay attention. But the payoff for that cost has been immense, a web of connections I’d never known about. I’ve gotten to eat with my brain as well as my tongue: every meal comes with a story. The geography of the valley now means something much more real to me; I’ve met dozens of people I wouldn’t otherwise have known.<sup>29</sup>

Such accounts may be understood as attesting to the plasticity of the desires that drive economic activities. But contemporary materialist social theory suggests a different framing, whereby “preferences” are not understood as attributes of individuals, however malleable, but rather as emergent properties of the dynamic, hybrid collectives that constitute circuits of production and consumption. This way of conceptualizing economic behavior facilitates a

<sup>28</sup> Barbara Kingsolver, *Animal, Vegetable, Miracle: A Year of Food Life* (New York: Harper Collins, 2007), 31.

<sup>29</sup> Bill McKibben, *Deep Economy: The Wealth of Communities and the Durable Future* (New York: St Martin’s Griffin, 2007), 94.

more nuanced understanding of what is at stake—especially ecologically—in the local food movement as well as in the broader trend toward production decentralization.

### **Decentralized Production: The Open Source Ecology Experiment**

In the developed West, the local food movement has become the paradigm case of decentralized production. But the ecological implications of localizing food production merit attention not only because food is a culturally and biologically crucial part of economic life, but also because enthusiasm for localized production is already expanding into other sectors. A growing chorus of observers, from futurologists like Rifkin to activist-entrepreneurs like Mark Hatch and Chris Anderson to popular forums like *The Economist*,<sup>30</sup> have hailed the coming of a third industrial revolution characterized by decentralized production and dispersed manufacturing.

Several enterprises and initiatives are presently emerging with the aim of jump-starting the next techno-economic revolution based on flexible manufacturing systems and dispersed, localized production of not only food and fiber, but also machines and durable goods. Marcin Jakubowski's Open Source Ecology (OSE) project is a prominent case in point.<sup>31</sup> Jakubowski's project has gained some notoriety after his 2011 TED talk, which was followed by a series of public lectures and successful fundraising campaigns.<sup>32</sup> The stated goal of OSE is to catalyze an open-source economy based on collaboration and distributed production. Toward this end, OSE's central project is to design and build the "Global Village Construction Set" (GVCS), a suite of "the fifty different industrial machines that it takes to build a small, sustainable civilization with modern comforts" (OSE website). The core of the GVCS is a subset of the dozen or so machines needed to fabricate all the other machines, as well as to fabricate new, collaboratively improved, and locally adapted iterations of themselves, all from materials close at hand. The GVCS includes a CNC torch table, circuit mill, bioplastic extruder, aluminum extractor (from clay), welder, compressed earth brick press, and other basic production tools.

Jakubowski's ultimate aims include the liberation of the human spirit, the end of toil, the dissolution of empires, and a new age of ecological harmony—all worthy goals. But such lofty rhetoric, along with the considerable distance between OSE's continual stream of optimistic projections and its actual progress, has earned Jakubowski his share of critics. My intention with this brief case study is not to defend OSE on its own terms, but to highlight the project as a worthwhile nuts-and-bolts experiment in peer production that fleshes out some of the details of what radically dispersed manufacturing might look like. OSE partakes heavily of the DIY ethos, but Jakubowski's vision is not a hyper-individualist Robinson Crusoe fantasy. We are asked to imagine, rather, a society where individual towns if not individual buildings and households produce their own power on site. Where raw materials like aluminum and bioplastics could be recycled and manufactured efficiently on small scales from local sources, and where assembly lines at the GloboCorp mill are replaced by local, flexible micro-factories

<sup>30</sup> The Economist, "The Third Industrial Revolution" (21 April 2012).

<sup>31</sup> See [OpenSourceEcology.com](http://opensourceecology.com). Frithjof Bergman's Detroit-based "New Work New Culture" project is another initiative aiming to promote distributed manufacturing (<http://www.newworknewculture.com>).

<sup>32</sup> Good sources of information on Jakubowski's project are Emily Eakin's 2013 article in *The New Yorker*, "The Civilization Kit," the Open Source Ecology website: <http://opensourceecology.org/>, and Marcin Jakubowski's TED talk: [https://www.ted.com/talks/marcin\\_jakubowski](https://www.ted.com/talks/marcin_jakubowski).

blending artistry, handicraft, digital technology, and practical productivity—perhaps on the scale of your mechanic’s shop. In the open-source economy that OSE gestures toward, your local mechanic could not only fix your biodiesel-electric car for a fraction of current repair costs, but could run off the parts and build a new one for you in a few weeks, and do the same for most of your household appliances.

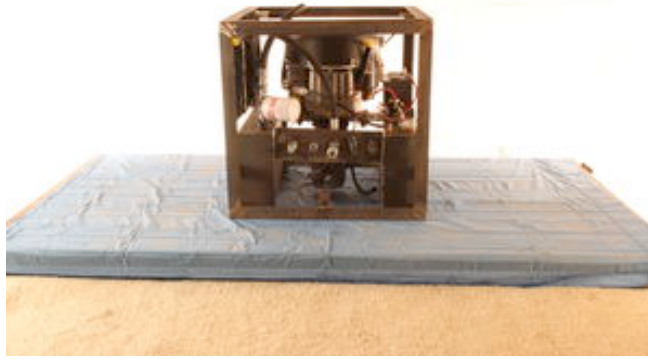
Such a radically localized material economy would rely on the widespread application of emerging digital technologies, particularly computer numerically controlled (CNC) manufacturing. CNC manufacturing can be either subtractive, as with CNC machining using routers, water jets, or lasers, or additive manufacturing, a.k.a. 3-D printing. This technology is especially important to the OSE vision because it has the theoretical potential to obviate economies of scale, making one-off production of uniquely tailored designs nearly as efficient as assembly line production of stock products. However, the full decentralizing potential of 3-D printing can only be realized to the extent that digital design files are open-source and publicly available. In this sense, the radically localizing potential of an open source economy largely depends upon the maintenance of the radically globalizing infrastructure that now enables information to flow freely on the internet.<sup>33</sup> It also depends upon innovators taking a leap of faith to share their ideas, but it is a leap that some are already taking on the wager that in an ever accelerating capitalist environment the economic benefits of collaboration and networking will outweigh the benefits of closed-door R&D.<sup>34</sup>



**Figure 1.** *The OSE compressed earth brick press creates bricks with high thermal mass from raw soil for use in passive solar construction. Image courtesy of Open Source Ecology (CC-BY-SA).*

<sup>33</sup> It is worth pausing to note that this global infrastructure is itself a considerable component of the material economy. A recent Breakthrough Institute article suggests that digital technologies may account for nearly 10 percent of global energy usage. See The Breakthrough Institute, “Bracing for the Cloud: Digital Economy Requires Massive Amount of Electricity,” (2013), accessed 27 September 2015, <http://thebreakthrough.org/index.php/programs/economic-growth/bracing-for-the-cloud/>.

<sup>34</sup> See Catarina Mota, “The Rise of Personal Fabrication,” *C&C '11 Proceedings of the 8th ACM Conference on Creativity and Cognition* (2011): 279-288.



**Figure 2.** The OSE “power cube” is a modular hydraulic power source used to power many of the machines in the GVCS. Like all OSE machines, it is designed to be inexpensive to build, simple to repair, and easily adapted to a variety of purposes. Image courtesy of Open Source Ecology (CC-BY-SA).



**Figure 3.** Jakubowski experiments with a tractor with an articulating chassis. Image courtesy of Open Source Ecology (CC-BY-SA).



**Figure 4.** A worker replicates the OSE tractor in California. Image courtesy of Open Source Ecology (CC-BY-SA).

OSE's hope for a post-industrial revolution that will humanize the economy by decentralizing production is not without precedents. The OSE project and the larger open-source "maker movement" out of which it grows can to some extent be understood as a digital-age re-hash of the late 19<sup>th</sup> century arts and crafts movement. Like the contemporary maker movement, the arts and crafts movement, which had its origins in the socialist politics of William Morris, aimed to re-distribute the means of production, particularly for the purpose of bringing together what the industrial revolution had separated: creative expression and productive labor. Morris's concerns were largely aesthetic; he felt that people should be surrounded by beautiful things. But his approach to the applied arts was conceived with the worker, or the "craftsman," in mind as much as the consumer. "It is right and necessary," Morris wrote, "that all men should have work to do which shall be worth doing, and be of itself pleasant to do; and which should be done under such conditions as would make it neither over-wearisome nor over-anxious."<sup>35</sup> The worker, or "craftsman," in Morris's vision, was to be both designer and producer, architect and builder. Accordingly, arts and crafts designs tended toward simplicity and functionality. Structural elements were left exposed, and the aesthetic was rendered in the medium of the mechanism, rather than pasted on after the fact. As such, arts and crafts designs lent themselves to the possibility, at least, of customized one-off production, ideally maintaining an accessible market price without the benefits of industrial divisions of labor. The hope was that simple, functional, beautiful objects could be produced by the people and for the people in a decentralized, democratized economy.

The arts and crafts or "craftsman" movement did not do away with the factory system or bring about a socialist worker's utopia, but it did register profound and lasting effects in the world of design, transforming architectural landscapes especially in Britain and North America. As such, the movement illustrates how the preferences of consumers may be affected by ideals, desires, and affections proper to the production process. The subsequent modernism that dominated the Western design world in the mid-20<sup>th</sup> century was largely focused on a certain idealized picture of the pure consumer, whose needs were magically met at the touch of a button. What is distinct about the arts and crafts movement, however, was that it presented an idealized picture of the *producer* and the production process, celebrating and making visible the way a thing is made and what it is made of, the skill of the maker and the excellence of the materials. Here, the materials, the structure, the process, and even something of the maker's personality are "opened" to consumers. They can be "read" in the made thing. "True connoisseurship," one might say, is encouraged. For example, something of the appreciation a woodworker gains for the visual richness and structural superiority of shade-grown hardwoods can be conveyed to users via the very form of the artifact. In this sense, craftsman designs were "open-source." However, where the arts and crafts movement aimed to reintegrate design and production and to aesthetically "open" the production process to the consumer, the radically decentralized economy envisioned by Jakubowski and other proponents of an "open-source hardware" revolution, would take this one step further, using emerging technologies to extend both design and production into consumption, and to dissolve not only the distinction between designers and producers, but also between users and makers.

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<sup>35</sup> William Morris, quoted in *The Craftsman* 1, no. 1 (1901): I.

From this perspective, production decentralization schemes need not be evaluated on the basis of whether the goods demanded by modern consumers can be produced more cheaply or more efficiently. Like the local food movement, the contemporary maker movement aims to reconfigure the means of production in ways that have the potential to alter desires, concerns, and preferences as people are incorporated into different economic actor-networks with different kinds of tools, machines, and technologies organized in different social and geographical configurations. Here, the pleasures and satisfactions of consumption bleed into those of creativity and production. Knowledge, information, and visibility are not just instrumental to the satisfaction of preferences but are also desired “goods” in themselves, inextricable from the utility derived from “use.” The “consumer” whose behavior economists are accustomed to mapping can itself be understood as an historically contingent subjectivity emerging from a particular set of technological, architectural, and ideational assemblages: arcades, reified commodities, electrical grids, corporate offices, factories orchestrated through corporate hierarchies, and suburban homes modeled on the idea of a site of pure consumption.<sup>36</sup> The alternative economy that OSE hopes to jump-start entails specific alternatives to these concrete material arrangements: tools and machines that are accessible and alterable rather than locked “black boxes” engineered behind closed doors with an eye to obsolescence, and flexible micro-factories and home workshops where production, consumption, and recreation are more often integrated.

Jakubowski sees this scale shift as part of a post-industrial, tech-friendly ecologism. The traditional anti-technological stance of “deep” ecology was portended by Martin Heidegger’s famous conclusion that the very essence of modern technology has led to an irremediable “enframing” of the natural world as so much “standing reserve” ready to be chewed up in our mills and factories.<sup>37</sup> This techno-phobic view is often contrasted with a facile form of “technological optimism” that sees technology not only as ideologically neutral, but also as the potential answer to any and all environmental problems. The kind of high-tech, global-village localism represented by the OSE project offers a third way to view the relationship between technology and ecology—a kind of technophilic inversion of the Heideggerian sensibility. “The ultimate message,” as Jakubowski puts it, “is that technology should be a way for us to connect to nature. If we’re using our local resources, relying much more on our local environments for all that we need, then we start to respect our environment much more.”<sup>38</sup>

This environmental ethics of proximity has an intuitive appeal. However, decentralized economic activities certainly do not have an unblemished ecological record. Yeoman wheat farmers caused the American Dust Bowl, and non-point source pollution remains one of the most intractable environmental problems. Simply dispersing the means of production, without other means of spreading ecological awareness, is not likely to yield a sustainable economy. It

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<sup>36</sup> Critical discussions of the role of the built environment in reproducing consumer subjectivity began with Guy Debord and the Situationists. Perhaps the most in-depth discussion can be found in Henri Lefebvre’s *The Production of Space* (Oxford, England: Blackwell, 1977). See also the works of David Harvey.

<sup>37</sup> Martin Heidegger, “The Question Concerning Technology,” in *The Question Concerning Technology and Other Essays*, trans. William Lovitt (New York: Harper and Row, 1977).

<sup>38</sup> Marcin Jakubowski, NEO Foodweb Interview (2011), accessed 2 August 2014, <https://www.youtube.com/watch?v=vxMSE58zEVs>.

could simply mean that environmental despoliation becomes more participatory. Yet ecological awareness—at least a certain form of it—is undeniably growing. The idea of sustainable flourishing is powerfully attractive to many, and it is worth considering whether we are mired in material-social-economic assemblages that frustrate its expression. What potentially puts the “eco” in Open Source Ecology is a faith not only in the ethics of proximity, but also in the possibility, attested to by the significant overlap between environmental and DIY movements, that the affective economies of localized production can generate modes of fulfillment beyond consumerism, and foster greater respect and ethical regard for the materials that make up the modern built environment, the things we make from those materials, and the natural world from which we draw them.

### **Commodity Fetishism, the “Ecological Rift,” and Affective Economies**

The movements, projects, and initiatives feeding the contemporary production decentralization trend are political to varying degrees, but they do not trade in the strident anti-capitalist language that characterized the “New Left” of the late 20<sup>th</sup> century. Perhaps this is for the best. However, it would be a mistake to gloss over the extent to which these movements are trading in insights that have long been theorized in Marxian terms. The idea that social relations can be obscured, occluded, and even obliterated by capitalism is an old Marxist saw. Commodities, as Marx famously claimed, are “fetishized” in modern market economies, insofar as, on the one hand, the social relations between capitalists and workers are obscured, and on the other, social relationships between the producers and consumers are forestalled. In this way, relations between people are “re-presented” as relations between things, the qualitative use values of which are subordinated in consumer consciousness to their quantitative exchange values.

What is missing from the fetishized commodity is more than information. It is the full-blooded social relationships that comprise economic assemblages, of which the eventual commodity is just one component (although, it should be said, a component that is a privileged node in the transmission of desires and attachments). And yet in the purview of traditional Marxist thought the “social” that capitalism precludes is often figured as centrally if not exclusively human. Here the relations that are hidden behind the user interface of the fetishized commodity are human-human relations, especially the exploitative ones between owners and workers. Contemporary environmental theorists, however, have drawn out a Marxian thread that begins to take account of how broader relational networks of production—particularly agro-ecological networks composed of places, organisms, materials, and nutrient flows—are also concealed behind the commodity form. This is the added value of John Bellamy Foster’s concept of the “ecological rift,” which draws upon Marx’s writings on the “metabolic rift” that opened as factory production replaced peasant production during the early days of the industrial revolution.<sup>39</sup> As Foster points out, the pioneering work of chemist Justus von Liebig on the cycling of nitrogen and phosphorous had drawn Marx’s attention, and he understood that capitalist production interrupted these cycles; the agricultural products of increasingly industrialized farms were transported over ever longer distances into cities, to be consumed by growing populations of urban workers, resulting in twin problems of urban

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<sup>39</sup> John Bellamy Foster, R. York, and B. Clark, *The Ecological Rift: Capitalism’s War on the Earth* (New York: Monthly Review Press, 2010).



pollution and rural soil depletion. Capitalism found ways to live with these issues. The depletion problem was eventually addressed by the fossil-energy-intensive Haber-Bosch process of fertilizer production, while the pollution problem would be addressed by ad hoc technological solutions to sewage management, which still today leave much to be desired.

Drawing on the work of Foster *et al.*, recent eco-Marxist commentary has expanded the logic of the metabolic rift to consciously attend to not only the rift in material flows, but also the concomitant rift or rupture in the flows of “sensuous knowledge” that are arguably crucial to developing place-based, ecologically intelligent agricultural practices.<sup>40</sup> In this view, the metabolic rift in matter/energy flows was also and at the same time a “knowledge rift” and an “epistemic rift” contributing to a general ecological blindness within capitalist culture. “Just as the spatial consequences of the metabolic rift erase sensuous knowledge of ecological relations and processes, so its social and ideological consequences obscure recognition of the ecological dimensions of economic/material relations and processes.”<sup>41</sup>

Eco-Marxist theorists are, unsurprisingly, among those who are deeply skeptical about eco-labeling schemes and “green consumerism” in general. In addition to the problems of consumer cynicism and information overload,<sup>42</sup> Marxian critics argue that eco-labels simply reproduce commodity fetishism in a new form, as “green” becomes just another brand, which only those businesses large and powerful enough to bend standards in their favor can afford.<sup>43</sup> Such green Marxist critiques lend credence to the arguments of local food activists and advocates of dispersed manufacturing who favor bringing everyday practices of production and consumption into closer proximity. However, the Marxian conceptual schemes that these arguments rely on tend to encourage ham-fisted critiques. They suggest a stark dividing line between the illusion of the commodity form and the social and ecological truths concealed behind it. The concept of a metabolic/ecological/epistemic “rift” easily slides into this same Marxian ideological binary, suggesting that saving ourselves from capitalism’s war on the earth would have to be a matter of a total conversion experience whereby the capitalist subject—ripped from the bosom of the ecological earth and set adrift in a world of commodified illusion—would be transformed into the revolutionary subject who sees the material truth of the economy and the “sensuously varied objectivity” of true “articles of utility.”<sup>44</sup> In this sense, Marxian social thought is haunted by its own version of deterministic materialism. Phillippe Descola describes it as the “common prejudice that the ideas organizing the use of nature are the ideological by-product of a supposedly objective practice. Were we to *restore to practice its purity*—its rationality, its purpose, its function—the clouds of representation would [according to this conceit] dissipate, reduced to the transparent veil of false-consciousness.”<sup>45</sup>

<sup>40</sup> See Mindi Schneider and Philip McMichael, “Deepening, and Repairing, the Metabolic Rift,” *The Journal of Peasant Studies* 37, no. 3 (2010): 461–484. See also Ivan Scales, “Green Consumption, Ecolabelling and Capitalism’s Environmental Limits,” *Geography Compass* 8, no. 7 (2014): 477–489.

<sup>41</sup> Mindi Schneider and Philip McMichael, “Deepening, and Repairing, the Metabolic Rift,” 480.

<sup>42</sup> Ian Hudson and Mark Hudson, “Removing the Veil? Commodity Fetishism, Fair Trade, and the Environment,” *Organization & Environment* 16, no. 4, December (2003): 413–430.

<sup>43</sup> Scales, “Green Consumption,” 482.

<sup>44</sup> Karl Marx, *Capital: Vol. I*, trans. Ben Fowkes (New York: Knoph Doubleday, 1977), 166.

<sup>45</sup> Phillippe Descola, *The Ecology of Others*, trans. Genevieve Godbout (Chicago, IL: Prickly Paradigm Press, 2013), 41 (*translation altered for clarity*).

But ultimately the purity of practice is itself an illusion. Production and consumption will never be fully transparent to themselves, and this is doubly true with respect to their ecological implications. Even the most radical localism would have its own affective occlusions and informational blind spots. Appreciating complex ecological problems like global warming, for example, requires forms of perception and logical extrapolation that are well beyond the purview of the most intimate local knowledge.<sup>46</sup> Rather than thinking in terms of truth and illusion, we should consider how different socio-economic assemblages facilitate different informational, ideational, and material flows among the various entities involved.

All economies are affective economies, incorporating wellsprings and circuits of information, knowledge, desires, identities, and ideals, as well as of matter and energy. Therefore a key question for environmental political economy is how to increase, enrich, and diversify the flow of information and affects alongside the life-supporting biophysical flows of economies and ecologies. It is here, and not only in the reduction of transport costs, that the considerable ecological promise of contemporary movements toward decentralized production lies. However, localism is no panacea. The neo-materialist insistence on thinking in terms of economic assemblages—in which agency is dispersed among networks of human and non-human agents, and in which affects and ideals are conceptually unmoored from sovereign human subjects—helps us see and articulate what is promising about this movement, but it also discourages overestimating it or parsing it in terms of true and false perception. It encourages us to think instead about different modes and means of production and consumption in their specificity, and ask questions about what sort of hybrid subjectivities any particular economic configuration tends to cultivate. What sorts of desires, sensitivities, or sensibilities can it help generate, manifest, or mobilize? Focusing on these questions could also help smooth the ideological terrain of environmental political thought to some degree, lowering barriers and facilitating collaboration between proponents of green consumerism and eco-labeling, local food activists, eco-Marxists, and advocates of post-capitalist open-source economics.

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<sup>46</sup> Ursula Heise has argued this point at length in *Sense of Place, Sense of Planet: The Environmental Imagination of the Global* (New York: Oxford University Press, 2008).

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