The future of food

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Introduction

How to feed the city? This has been a predominant question during recent centuries of human development. Conventional solutions are revealed as unsustainable in the long term: massive chemical inputs, factory farming and agribusiness, global food imports. A new approach must therefore be found. This chapter addresses the scope of producing food *in* London itself. As a conceptual approach, we define a 'backcasting' methodology and outline the different levels and relationships of an urban food system, as well as the wider parameters which form its context: the revolution of rural agriculture, and the solar transition. We propose a threefold categorisation, namely the urban forest, subsistence plots, and ultra-high productivity farming. In each case, we illustrate the potential from existing experiences, while being aware that the emergent possibilities of the new ensemble will far outstrip the sum of their parts.

Framework and methodology

We could interpret 'food in London' to mean a situation where London, as object, gets food (sustainably) delivered *to* it. Here, I take an opposite approach: London's people as *subject*, possessing food autonomy, control over land and knowledge. Currently, this concept would be named 'food sovereignty' (Pimbert, 2009), although there are on-going debates which may re-define or replace this term eventually.[1] Although food *consumption* (and the interactions arising through it) would be an important topic, I will focus on production.

My methodology is similar to backcasting: visioning a desired outcome and building back from it. This differs from forecasting or scenario-building, both of which build forward from the present (Wearerising, n.d). We don't therefore detail the *un*desired (e.g. Mad Max-style) futures

[1] Developments in Mexico suggest, for example, that the term may be subject to co-optation by ruling interests: Rita Pérez, personal communication.

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which could follow ecological crisis. Nevertheless, the tasks of *avoiding* these will be addressed. Though this vision is personal, it needn't be merely subjective: we will be identifying trends within today's food-related experiments as future growth-points; while insights from general systems theory can help us understand how systems evolve and acquire resilience.

We can't analyse food separately from wider changes; here, we assume three:

1. Today's political, economic, social and institutional crisis has been resolved in favour of radically increased equity and community control.
2. Society adapts to life without fossil fuels.
3. Climate adaptation and mitigation are central concerns.

While these three conditions are *broader* than the food issue, they're not *external* to it:

1. The bottom line for socio-politico-economic futures is to feed the people, and it is precisely over land and food that many key struggles for rights are focused.
2. Food growing is the most basic way to harness solar energy, and a key area for minimising emissions.
3. It is inseparable from both the problems of and responses to climate change (combatting erosion, conserving water).

The technical shift to solar economy, and societal restructuring, will occur through mutual interaction (Schwartzman, 2009). London's climate will be different in 2062, most likely warmer, though possibly colder; but at least we're certain there will be less stability and more extreme events. Within a given year,[2] it will be warm or cold at the 'wrong' times, confusing plants and animals. So adaptability and resilience are key.

A systems approach to food

In visualising a systems approach to food, it is helpful to think of an 'urban metabolism', whereby flows – of resources, of 'waste' from one process becoming an input for another, of water – serve as a physical medium for networks and transactions linking people and communities. We must also address the time dimension, through which systems evolve. In this respect, systems adapt to step level changes, which on the one hand confront them as challenges (extreme environmental events, for instance), but which on the other hand they learn to *embrace*, thus making radical change an integral mechanism of their own development: this is the meaning of 'transition'.

Food systems occur at different 'levels' or scales, nested within each other; networks or 'chains' run through and between them. London lies within national and international food chains, and is internally differentiated into Greater London, Inner London, and the community/locality. Our system rule is that exchange is good, provided it minimises entropy, i.e. exports of disorder. No level should build its order at the expense of degrading either its surrounding system ('environment', physical or social), or any excluded and super-exploited regions.

What we must escape *from* is today's situation, where food security in the global North is achieved by degrading the environment of the South; everything is achieved by degrading the soil; urban food systems squeeze the farmer through corporate dominated chains; and poorer communities suffer deprivation. There is an intrinsic link between injustice and wastefulness: the process of exploitation is simultaneously a loss of quality (nutritional quality [Caldwell, 1977]), but also a negative Energy Return on Energy Invested (Glaeser & Phillips-Howard, 1987). Rebellions

[2] This was already the case in 2008 and 2011.

of the oppressed thus reduce entropy. The repercussions of such events will be worldwide. We assume that today's exploitative world food system – where extreme concentration of knowledge and landholding obliges farmers to export food at the expense of local staples – will have been overthrown by grassroots food-sovereignty struggles in the global South. London's local food system will have changed step by step against this background. The apparent 'constraint' of not being *able* to import food will, in a positive sense, bring about a transformative rise of creativity.

The resultant systems will remain interlinked through (non-exploitative) chains and networks, which stimulate emergent properties of the whole. At the same time, there's a strong dose of local self-sufficiency (within each community, within Inner London, within London relative to wider systems). This is *partly* to minimise food miles, but mostly to gain resilience to shocks: where higher-level structures are trashed by extreme events, systems must regenerate from anywhere (Brafman & Beckstrom, 2006).

Growing technique and institutions are analogous: each minimises energy/input. So, just as low-input farming accesses the soil's self-organising properties, institutions draw free energy from human resourcefulness. Imagining networks as *rhizomes* (Deleuze & Guattari, 1987) further emphasises the analogies. Much of systems thinking on food (call it agroecology, permaculture or whatever) envisages changing farming and society in tandem; in both cases, creativity springs from shunning too much equilibrium, focussing on the *edges*, the margins (Chinmay, 2009; Whitefield, 2004).

Comparing different levels, we find certain 'isomorphisms' (structural similarities) between them. Thus, institutionally, commons regimes work equally well whether at intimate micro-levels (for a tangible resource like a piece of land); or globally, as in the infosphere, through open source knowledge. With increased co-operation a logical response to crisis (Nowak, 2006), regimes undergo resurgences, forming the major single principle of organisation at each level.

Do we find such isomorphisms in the food growing sphere too? Only partly. All levels are similar in pursuing sustainable principles:

1. conserving soil structure
2. diversity of crops, and of strains within each crop
3. biodiversity in a larger sense, i.e. working with wildlife, pollinating insects, natural predators
4. working with plants' natural resilience.

These embed complex order (resist entropy) in the land itself. But food systems may be radically *dissimilar* as we change levels, especially between the urban and the rural; with peri-urban farming sharing features of both.

Components of urban agriculture within a wider food ecology

In a static sense, Britain could feed itself *now* (Fairlee, 2007). But in our longer fifty-year timescale, we must halt long-term degradation trends. For this, drastic changes are needed. Some are organisational: plantation/agribusiness gives way to something else, perhaps smaller farms (Rosset, 1999), accompanied by de-urbanisation. But more profoundly, humanity must, by 2062, have resolved today's threatened disappearance *of the soil itself* (Hough, 2010), an issue sometimes called 'peak soil' (Montgomery, 2008). Soil now vanishes at up to fifty tonnes per hectare per year, 100 times faster than it is formed (Banwart, 2011). With soil conservation 'central to the longevity of any civilization,' (Montgomery, 2007) this already impacts on UK policy (BBC, 2009). The answer lies in linking carbon sequestration and soil fertility: a benign positive feedback loop, since high carbon-content soil promotes more growth and thus more sequestration (Brown, n.d). Soil

holds nearly three times as much carbon as vegetation and twice that of the atmosphere, the use of no-till agriculture maximising its potential in this respect (Wang et al, 2011).

Climate mitigation and feeding the people should therefore be 'win-win', but how to kick-start it? Today's ideas include large-scale ranges where animal grazing acts as a carbon pump (Norman, 2001; Savory, 1983); or a charcoal based method replicating the 'terra preta de indio' of the ancient Americas (Taylor, 2010). These are big debates, outside our scope here. Suffice it to say, there will be huge changes in rural farming, within which is inserted an urban system, probably very different from the rural one, but equally radical in the changes it implies. The latter is our focus here.

Such changes, meeting the goals of equity, dis-alienation from nature and energy descent (a term used in the Transition movement to denote the steps leading to a 'visioned' low-energy future), liberate the city's genius for self-organisation. Farming and built environment are no longer sharply separate (Wilson, 2009). Food growing takes many forms. Though these shade off into one another, to simplify, I'll propose three categories:

a) the urban forest
b) subsistence plots
c) ultra-high productivity farming.

Firstly, in relation to what I am calling the urban forest, 'greening' the city will be thought of differently, mainly in food terms. Transition models rightly insist that we consider trees as producers of fruit and nuts (Hopkins, 2008), a strategy already underway in London (The London Orchard Project, n.d). Not only will edible urban forests, once established, have their own self-maintaining ecology (Ettinger, 2012), but the process of creating them is *itself* emergent, a spontaneous encroachment of growing spaces, as already foreshadowed by the squatted community of Bonnington Square, Vauxhall (Self-help-housing, n.d). Guerrilla gardening (Reynolds, 2008), referencing guerrilla as a diffuse, self-organising form, is a societal struggle conducted through the self-organising capacity of nature: as in its adaptation of Masanobu Fukuoka's seed-balls (whereby plants themselves choose where to grow) as 'seed-bombs'.[3] Hidden rivers like South London's Effra will be re-created, with re-established habitats redressing today's deficit of natural predators like frogs and hedgehogs. Through the networking of green fingers, agriculture becomes seamlessly part of the city.

Secondly, let us consider how urban subsistence farming may impact food security. Between the wars, perhaps 700,000 tonnes of vegetables grew in English and Welsh allotments, numbering about a million plots[4] (Acton, 2011). This might feed four million people. The volume is encouraging. But top-down strategies, placing food security within (military) national security, pushed allotments only in short bursts, typically wartime, gaining a strong initial output through chemicals only for diminishing returns to set in.[5] We, on the contrary, aim for high production in the long term, 2062 *and beyond*. For this, the soil's own structure and fertility must always be renewed.

This we achieve through organic mulches[6] (Dowding, 2007). Taking the traditional allotment (250m^2), converted to a no-dig method with paths between beds, our cultivable surface is about

[3] As a variant of this, 'Guerrila Grafters' in San Francisco are grafting fruit-bearing branches onto ornamental cherry, plum and pear trees (Zimet, 2012).

[4] Figures are from 1923, and include 200,000 tonnes of potatoes.

[5] In 1944, there was an attempt to convert the wartime 'Dig for Victory' slogan into a more permanent 'Dig for Plenty' (http://www.nationalarchives.gov.uk/theartofwar/prop/production_salvage/INF3_0098.htm); however it lacked a clear orientation and soon fizzled out.

[6] The mulch also shields the soil from erosion, prevents water loss, and suppresses weeds.

150m^2. Allowing for a typical 40mm mulch (Corbalan, 2005), over 150m^2 this gives 6m^3. But, only half is internally generated by the plot.[7] This gives a figure for what we require from the urban metabolism, in the form of compostable waste.[8] Where today's visioning of metabolism, as industrial ecology or industrial symbiosis,[9] tends to view agriculture peripherally, as an outlet or sink; in that of the future it will be central.

Significant scope exists to expand urban subsistence farming. In today's Elephant and Castle, potentially cultivable land could maybe yield 26% of the population's vegetable needs[10] (Tomkins, 2009). But this doesn't necessarily mean more conventional allotments. While I hope there'll still be a role for them (allotments *have* kept alive commons regimes against all odds!), the new urban farmland will be institutionally innovative: community land trusts (Davis, 2010) could be a starting point.

Thirdly, to complement the previous two categories, we assume an ultra-high productivity sector, but what form will it take? We must unquestionably embrace cutting-edge science in this respect. A key issue remains, however: how far can or *should* we try to free ourselves from nature? There's a historical legacy of false aspiration to control/circumvent nature (Merchant, 1990). The above question could further be resolved into two aspects, [i] *energy medium* and [ii] *growing medium*.

Lighting by light-emitting diode (LED) already makes possible highly energy efficient growlights in a mixture of red and blue wavelengths (used experimentally with success by the author); given LED's current exponential trajectory of efficiency gains, we can confidently predict by 2062 a technical revolution opening up the possibility of growing food inside buildings (either multi-use ones, or ones built specially). Futuristic visions often assume this (Despommier, 2010). As we write, these move a step closer, with 'plantscraper' models on the point of realisation (Ma, 2012). Nevertheless, there are problems: most obviously, since the only fundamental defence against entropy is drawing energy from the sun (Georgescu-Roegen, 1975), the most straightforward way is still to expose plants to it directly. More subtly, we respect the principle of working with/like nature, one aspect of which is plants' natural defences: their biorhythms being synchronised with that of insects (Solon, 2012); artificial light could pose problems. This might be addressed through the solar energy medium combined with non-soil growing medium, as in hydroponics... but not fully. Plants still need soil in order to 'network': for example, only by chatting through fungal and mycorrhizal filaments can they fully trigger pre-emptive responses to disease (Song et al, 2010). Such information-exchange should not surprise us. In organic farming theory, humus is a complex system in its own right (Howard, 1943), and in complexity theory, we re-phrase entropy in information terms (Morin, 2008). Thus, to safeguard soil against degradation (structure-loss) means also to nurture its capacity for information storage and transmission.

This makes me doubtful about going too far in 'escaping' nature. But, given London's latitude and food crops' need for light, a more conventional, *but intensive*, soil based, natural light system can flourish if we move upward. The key area is rooftops, with greenhouses insulated, not heated. The SolaRoof model is interesting here: because open source (SolaRoof, n.d), it anticipates a wider flourishing of knowledge commons.

But the point is not to *restrict* technical innovation in the ultra-productive sector. On the condition that its own self-organising principles interlock with those of nature, it can be as daring as it pleases, through hydroponics or whatever. Today we see this in the work of Will Allen in Milwaukee (Herzog, 2010), where a multi-layer aquaponic greenhouse system, heated by com-

[7] Author's research.

[8] A similar calculation could be made for water.

[9] See www.tees.ac.uk/docs/DocRepo/Clemance/IndustrialSymbiosis.pdf for a typical diagrammatic presentation.

[10] Calculated on the basis of a population of 16,245, using UK weekly vegetable consumption of 1,600 g, giving an estimated potential yield of 267 tonnes.

posting, carries water populated by fish and purified by the plants themselves: a spontaneously self-regulating system.[11]

In relations between the different sectors and levels, there will be some specialisation. Limits to this are posed by the resilience condition (with extreme events, climate fluctuation and disturbed seasonality the norm, each plot must have some self-sufficiency, spreading its options by growing many crops and strains). Nevertheless, specialisation between peri-urban and central London are key; this dialogues with the garden city and green belt traditions in British planning history. Along lines pioneered by Community Supported Agriculture, and specifically London's Hackney Growing Communities (Growing Communities, n.d), peri-urban farms grow staples like cereals, while other crops (salads, or those like peas and maize, where sugars rapidly convert to starch) grow closer to the point of consumption.

The above are some of the elements. Where it gets exciting is the emergent properties of the complex whole. The mechanism for such emergence is networking, a rebuilding of society's information content. We see this just beginning now with the rise of new social and productive relations, at the same time highly concrete and linked intangibly through the infosphere (Local Harvest, n.d). Such spaces, or "islands of unpredictability" (Carlsson, 2008), will by 2062 have coalesced into emergent forms which can barely be envisaged today.

Pathways of transition

The identifying feature of backcasting is starting from the future. Clearly, however, where we'll be in fifty years depends on how we get there: that's the issue of transition. Today's transition models arguably underestimate the radicality of *social* changes needed (Biel, 2010). It's true we're *defending* structure, both of soil and of society, against the entropy threatening to engulf it, and therefore logically pattern social organisation on nature. Nevertheless it's too easy to dress up existing hierarchies under a semblance of biomimicry. Futures thinking should, in pursuit of new paths, accept the need to 'break' existing path-dependencies (Tiberius, 2012), which implies identifying correctly what these are. What's causing today's food crisis is inseparable from a certain dangerous momentum from within the mode of production itself, which currently degenerates in two complementary/contradictory ways, both of them depleting order: [a] a concentration of power at the top; [b] a chaotic disaggregation, parasitised upon by finance capital (Biel, 2012). Both are strongly present in the food system: dis-embedding knowledge, appropriating genetic resources, land grabs (driven equally by militaristic food security projects and chaotic speculation). If we're to have any future, humanity must conquer this degeneration, a process which must build upon the forces *now* resisting it.

To understand these forces is to understand future institutional structures. The roots lie in the global South, most easily traceable to the late 1990s in the impact of the Mexican Zapatistas and Indian farmers' movements (Ainger, 2003). This tradition of struggle tends to surface in a succession of forms, which have recently included a Land and Freedom camp (October 2011) on London's Clapham Common (which referenced global struggles (Heggs, 2011), as well as the Diggers' 1649 occupation in what is now London's outskirts) and shortly afterwards the Occupy movement, critically highlighting issues of land/space and which included Occupy Our Food Supply (Occupy Our Food Supply, 2012). However ephemeral its specific forms, we can reasonably see this as a coherent current of struggle likely to grow in strength.

The right to land has never been wholly separable from how that land is managed: distribution in isolated plots provides little defence against predation, whereas commons might. Appropriately, 2012 is the year of co-operatives (United Nations, n.d); they have momentum on their side,

[11] Author's notes on a presentation by Will Allen, London 2008.

with co-ops now quietly challenging the conventional economy (Bollier, n.d). In today's London, OrganicLea provides maybe the best example of what could be achieved (Organic Lea, 2013): the conditions for *replicating* this are already under debate (Reclaim the Fields, n.d). The struggles in which they are born thus influence the institutional forms of London's food-growing future, the restructuring of society itself co-evolving with the systems by which it is nourished.

Conclusion

The future of food in London will be one where challenges will have been embraced as opportunities, in which the self-organising properties of society complement and intertwine with those of nature. The city will in one sense appear 'wilder', with a new generation of green buildings and green corridors in which self-balancing populations of birds, insects and small vertebrates control what were once considered 'pests'. At the same time, a high-efficiency urban farming will employ biomimicry approaches like intercropping to operate through patterns of interdependent diversity, replicating those of natural systems. Scientific research will both facilitate and draw data from the constant experimentation of practical food-growers, while in an institutional sense, new property relations in land and space, such as commons regimes and community land trusts, will open up society's creative potential. A snapshot of 2062 will therefore above all reveal a city in the midst of a many-sided adaptive and proactive process of emergence and development.

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