EMULATING THE CIRCLE OF LIFE

We need to rethink efficiency in our food system, writes **Robert Biel**

The tendency towards decay (known as entropy) destroys order and reduces everything to randomness. But a system can create order, if there's a flow running through it. This happens with the Earth: solar energy enters in, and the Earth sheds ('dissipates') waste heat into space. Individual animals and plants do this too; and, taking the Earth system as a whole, the waste excreted by one component is absorbed into another, with the result that the flows are 'tucked in'. As James Lovelock says, the pollution of one is the meat of another.

When we build or manufacture things that don't exist in Nature, the bad tendency has been to neglect the tucked-in loops, so there's simply a lot of energy and scarce matter flowing into each process, and a degraded form of these is pumped out in the form of garbage, pollution and greenhouse gases. But we can address this problem by introducing a circular-systems approach. A good example is industrial ecology (or industrial symbiosis), where many productive processes are networked, the waste of one becoming "the meat of another".

My own work is to do with food systems, and in fact there's always a food-growing component in industrial ecology, because urban farms can absorb a lot of by-products: grey water, surplus heat (which could warm greenhouses), and compostable waste (such as hops from breweries). This is one reason why urban farming is potentially more productive than rural farming, and contributes to an 'urban metabolism', characterised (like the body's metabolism) by flows and circulation. I participated in a project as part of University College London, setting up an anaerobic digester: a bicycle-driven box collects waste from local restaurants, and the composting process reduces it to digestate and methane gas. Food is then grown using the digestate as fertiliser and cooked using the gas, and we serve it in the project's café – so the loop is closed.

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These experiments are really interesting, but we should also think critically about what we are trying to achieve, and how. Thus, in industrial ecology, we shouldn't let the food sector be treated merely as a sink for whatever industry wants to get rid of; at the very least, let's insist on defining its role in terms of what farming actually *needs* from the urban metabolism, rather than simply what it can absorb.

Also, in a broader sense, it's a lazy solution to merely give crops a lot of inputs, because this inhibits plants' abilities to strengthen themselves. In some amazing experiments, French peasant Pascal Poot deliberately lets his crops fend for themselves in the harshest conditions, and they develop a heritable capacity to cope. The scientific explanation has to do with which genes are 'expressed' (switched on): if the plant doesn't need them, they stay dormant! Also, applying fertiliser high in nitrogen – as tends to be the case with digestate from anaerobic composting – may accentuate a major form of pollution, which in turn triggers CO_2 emission.

The food issue prompts a further interesting question: if we speak of closed-loop systems, how far is it really desirable to be closed?

It's an exciting challenge to be self-reliant. I've found it's not too difficult to produce all our family's vegetables on our own plot, while still leaving time to do other jobs. This is achievable because a no-dig (no-till) system minimises inputs of work: by not working the soil, you encourage natural balances to self-engineer, so that fertility is maintained through the free energy of self-organisation. Residues are composted back, and the deep

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