AMBIO 2012, 41:765–766
DOI 10.1007/s13280-012-0314-1

KUNGL. VETENSKAPS-AKADEMIEN
THE ROYAL SWEDISH ACADEMY OF SCIENCES

COMMENT

Comment on article "Is There a Metabolism of an Urban Ecosystem?" by Golubiewski

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Received: 10 March 2012 / Revised: 7 May 2012 / Accepted: 24 May 2012 / Published online: 27 June 2012

Having published a review of urban metabolism (UM) literature (Kennedy et al. 2011), three criticisms can be raised with Golubiewski's article:

1. The paper has a tendency to misunderstand the intentions of UM researchers, and makes incorrect assertions about what UM studies are trying to achieve. It was difficult to follow the reasoning behind assertions such as "Proponents of UM assert that because it makes explicit the resource/waste pressures of a city, it constitutes an ecological assessment" and "With such statements, UM research aims to connect ecology and economics." These are not apparent from the UM literature. It is well understood that fully connecting ecology and economics requires some form of integrated assessment, with UM as a key component (e.g., Fung and Kennedy 2005).
2. The critique tends to be overly focussed on loose statements in the UM literature in which the analogy between cities and organisms has been taken too far. I agree with the criticism of the analogies made in the paper on the UM of Hong Kong. To focus on the somewhat loose analogies in the paper, however, should not take away from its main contribution of showing alarming changes to the metabolism of Hong Kong from 1971 to 1997. Moreover, just because at some point an analogy breaks down, is not a good reason to throw it away entirely. There is some depth to the observation that the metabolism of cities is like that of an organism. Cities are not living organisms in the biological sense, but they do grow, they do produce (or rather transform) energy and they do eliminate wastes. Moreover, the metabolism of the city is like that of an organism partly because of the way that urban infrastructure systems are designed. They are human-made systems that massively change the natural ecosystem as they grow outwards into surrounding countryside. They are also often centralized systems, meaning for example that net wastes are collected and concentrated at a small number of outflows, rather than being broken down by spatially dispersed detrivores. This organismal nature of the UM is, however, perhaps an emergent phenomena that is only perceived at the macroscale—and hence typically goes unrecognized in microscale analysis of urban ecosystems.
3. The review erroneously suggests that UM needs to be given up for urban sustainability research to make progress, inappropriately citing Gandy and ignoring a large body of interdisciplinary research from the past 5 years. Kennedy et al. (2011) referenced over 50 papers studying either singular or multiple components within UM. Major recent UM projects of the EU (BRIDGE and SUME) and the California Energy Commission already include the "socio-ecological integration" that the author called for. UM research did not remain "frozen" and was able to establish the "analytical utility" that Gandy was unable to see in 2004. A practical example is the reliance of GHG inventories for cities on UM data (Kennedy et al. 2009). From a design perspective too, UM has emerged to be a useful analytical framework that is used for teaching sustainable design to architects and engineers at institutions such as MIT, ETH Zurich, and University of Toronto. UM is such a simple concept at its core—the energy and material flows through cities—that is has grown to be key for interdisciplinary research on urban sustainability. The literature includes contributions from many disciplines: architects, ecologists, economists, engineers, geographers,

historians, mathematicians, physicists, urban planners, and others.

Beyond these three points, the critique of UM does provoke some useful questions. On the issue of conflating terms, it is right to be critical of Newcombe et al. for using the words ecosystem and organism as if they have the same meaning—which they do not. There is a deeper issue here, though. Given that cities are both (real) ecosystems and are metaphorically like organisms with respect to metabolism, how can terminology be developed to suitably capture both? To a large extent I agree with the author that "In a truly comprehensive analysis of the city, the pools and processes of vegetative biomass would be considered in addition to buildings and other material stocks." Indeed UM studies of Tokyo, Brussels, and Paris have included both the biotic and the abiotic components. It is possible to combine anthropogenic organism-like metabolism with ecosystem metabolism; UM research has not relied on Odum's "ecosystem-as-superorganism metaphor."

There is one practical caveat here though, which is the tendency for the anthropogenic metabolism to dominate the natural ecosystem metabolism in cities. When the aggregated, macroview of cities is taken, the anthropogenic system tends to dwarf the natural system. Carbon sequestration by the urban canopy in Toronto, for example, is <1 % of the GHG emissions from anthropogenic sources; similar results apply to many other developed cities. Was it useful to include the organic discharges from cats and dogs in the Brussels metabolism, if they are such a small component compared to the human discharges? This relatively small contribution of the natural urban ecosystem to the UM perhaps explains to a large extent why it has often been left out.

Current day UM researchers are, nonetheless, keen to incorporate both the natural and the anthropogenic components in their analyses. One result of a UM workshop held at MIT in January 2010 was a comprehensive framework broadly describing the biophysical stocks and flows of the UM. The framework includes production of biomass, as well as natural energy and water balances (Hoornweg et al. 2010).

Many more questions are provoked by the paper, but space only permits one more. As the city is an ecosystem, and the study of ecosystem metabolism is well recognized in Ecology, does this mean the answer to the question "Is there a Metabolism of an Urban Ecosystem" is yes?

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