(urban) metabolism studies

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an extraordinarily brief history

- Abel Wolman introduced the idea in a 1965 Scientific American article.
- Newcombe et al (1978) significantly contributed with their metabolism study of Hong Kong.
- The UNESCO Man and Biosphere further promoted the metabolic approach in the 1980s.
- Chris Kennedy (my advisor) and colleagues have worked on urban metabolism studies for the GTA.
- In all cases it has always had an eye towards growth and resource management more so than (or as much as) environmental protection.

what it's not

Environmental Impact Assessment

- Has a sense of what an environmental 'impact' is vs. 'normal' environmental activity
- Trying to assess (potential) damage
- This definition could be used to describe many studies that are not typical EIAs

Ecological Footprint

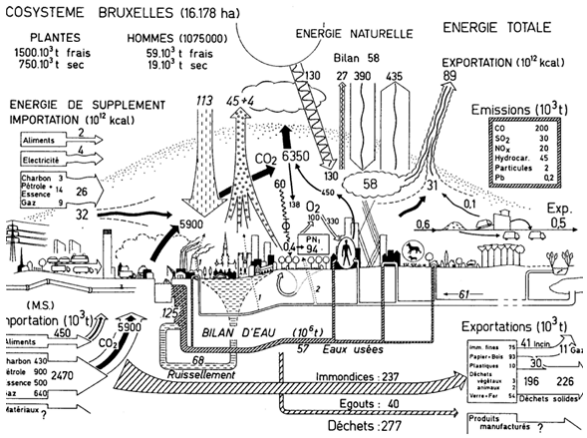
- Frames resource usage in terms of land area required to sustain it
- Typically uses linear assumptions about resource consumption per unit of activity
- Is bottom-up; wholes are collections of activities

what it is

- An assessment of material and energy flows into and out of a city (or other system)
- Focused on mass and energy balance
  - > what goes in must come out…
- Is based on stocks and flows
  - >…or accumulate

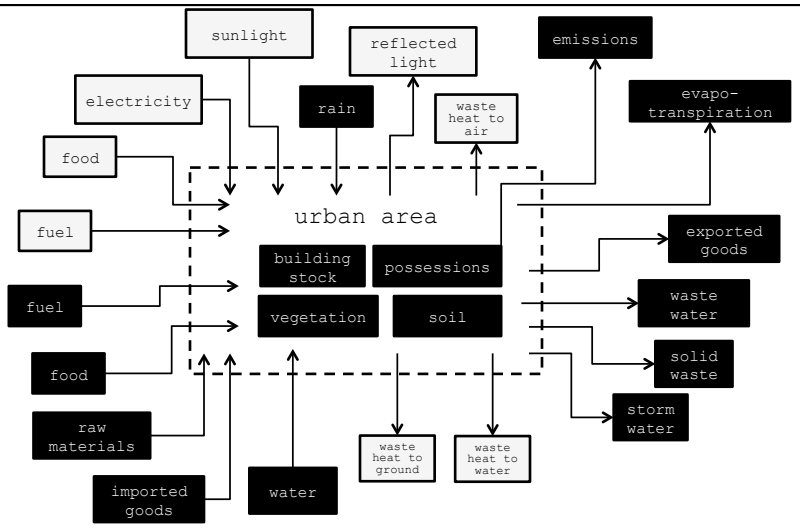
why it's important

- We aim to understand a system's dynamics so that we may prevent or correct hazardous behaviour.
- It is apparent that the resource consumption and pollution of cities (and anthroposphere in general) has become hazardous to the global ecosystem.
- Thus, understanding how cities consume resources and transform them into pollution is imperative.
- (Urban) metabolism studies are a systems thinking approach to that.



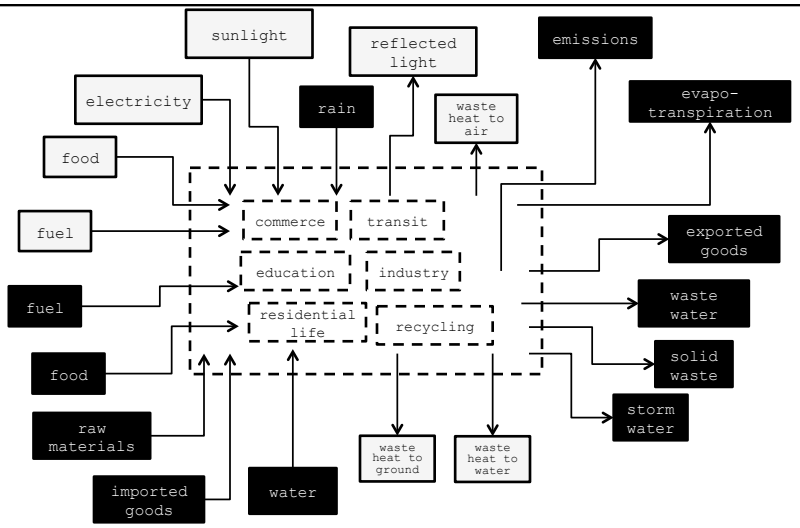
metabolism diagrams

Diagrams are often presented as quasi-pictorial to provide a better context for the flows.



metabolism diagrams

Traditional stock and flow diagrams are also used. Most frequently (and feasibly) they represent an urban area as a black box.



metabolism diagrams

Sub-systems can be modeled as well. Dashed lines typically represent system and sub-system boundaries. Loops (not shown) can also show how materials and energy circulate between subsystems.

looking forward

- Control opportunities exist on different scales: national, provincial, municipal, institutional, etc.
- A systems thinking approach to anthropospheric metabolism that were scalable – one where you could move fluidly between different system levels – would be quite powerful.
- My research is directed towards identifying simple and measureable stocks, flows, and system parameters that are scalable through a range of system levels.
  - > e.g. thermal sensitivity of energy consumption