Measuring the Metabolism of an Area

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Abstract

The increasing trends of urbanization and the reformation of urban economies are the key factors that determine urban development in the 21st century. The interconnection of urbanization trends and environmental pressures, are due to the rising demand for resource consumption, waste production and emissions. Taking into consideration problems such as the reduction of natural resources, the degradation of the quality of life and the climate change, the scientific community indicates that it is necessary to study the relationship between cities and the environment in order to understand their dynamic interactions.

The world's population it is growing by 1.10% per year, yielding an additional 83 million people yearly. The population is predicted to increase more than one billion people over the next 13 years, reaching 8.6 billion in 2030, and to 9.8 billion in 2050 and 11.2 billion by 2100. According to United Nations (2016), cities allocate about 50% of world's population, and it is expected that this number will increase up to 66% by 2050. Although urban areas account only 4% of the Earth's land surface area, they are responsible for 80% of carbon emissions and 60% of water consumption. In 2015 the 'ecological overshoot' was estimated to be '54% above the planet's biocapacity' meaning we need 1.5 planets to live sustainably. Cities are not sustainable because they do not use resources rationally. Overall, cities have a linear usage of resources and waste production, without feedbacks of resources in terms of quantity and quality. Consequently, cities worldwide are facing the challenge to find and implement alternative strategies towards more sustainable management of urban resources. Therefore, understanding urban metabolism and the processes that drive it, is the key to transitioning from ecologically extractive to sustainable cities.

An urban metabolism analysis aids four main purposes: the first one is connected to the assessment of materials and energy flows throughout a city, the second aims to quantify greenhouse gas emissions, and third and fourth applications use material and energy evaluation to support decisions concerning public policy. This paper purpose is to identify and valuate the main methods used for urban metabolism analysis. Emergy analysis, Material Flow Analysis and Ecological footprint calculation are the three basic methodologies that attempt to quantify flows of material and energy in complex systems at multiple scales and can be incorporate into the urban metabolism framework. Furthermore, the paper highlights the basic threats and barriers for the implementation of each of the method analysis.

Keywords: Urban Metabolism, Energy analysis, Material Flow Analysis, Ecological footprint