

## Essential Societal Service Functions and Planetary Boundaries: The Case of Sustainable Urban Water Management

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2017, 25th - 29th June

## ISIE 2017: Science for Sustainable and Resilient Communities



### Essential Societal Service Functions and Planetary Boundaries: The Case of Sustainable Urban Water Management

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My main research area is combining risk and quantitative sustainability assessments for flood risk assessment to develop decision support tools that help decision makers take more sustainable decisions in the light of the associated risks and uncertainties. I am also working with input uncertainty for such models, especially on rainfall in a changed climate.

#### Abstract

The United Nations Sustainable Development Goals dictates that a range of essential societal services have to be delivered globally. These services have to be sustainable in absolute terms with potential of being put to use everywhere in the world. Regarding sustainable urban water management, the sustainable development goal 6 "Clean water and sanitation" is essential but also services related to e.g. goals 11 "Sustainable cities and communities" and 13 "Climate action" are central. Half the Earth's population live in cities today and this number is expected to increase in the future making sustainable urban water management central in meeting the United Nations Sustainable Development Goals.

Absolute sustainability can be assessed using planetary boundaries as a normalization reference for environmental impacts, defining a total carrying capacity. Here, we focus on impacts caused by societal services related to urban water management and assess how they relate to the carrying capacity of the users.

These normalized results make different technologies comparable in an absolute, quantitative way, which can support the development and implementation of solutions with minimal negative impacts. This is especially relevant since societal services will influence the environmental impacts for a many people, which usually cannot influence the system themselves.

Urban water management consists of a range of societal service functions. Provision of drinking water and removal of sewage water are obvious services. Less intuitive functions such as flood risk management, creation of livable cities through greening as well as ecosystem services are also provided and play a major role at the policy and planning levels of modern urban water management. In the present study we focus on three distinct urban water management service functions: **1)** provision of potable drinking water, **2)** treatment of sewage and stormwater at a wastewater treatment plant and **3)** providing infrastructure that manages flood risk to an acceptable level. Life Cycle Assessments have been carried out previously for all three service functions as separate systems, and we re-reference these studies using a common anthropocentric functional unit: a person receiving these services. We then normalize the results with reference to a person's carrying capacity.

For a person living in Copenhagen, Denmark, with the services in place there, emissions of greenhouse gasses is the biggest concern (12-25% of entitled carrying capacity); primarily due to high energy use at the wastewater treatment plant. This is clearly a problematically high share, and emissions have to be reduced significantly. This could be either through enhancements of the main processes at the treatment plant or through a decoupling of energy production and greenhouse gas emissions at a much more general level. Following is eutrophication of the marine environment (approximately 3% of entitled carrying capacity) which is a consequence of the discharge of treated sewage from the wastewater treatment plant. Even though the share of allowed emission embedded in this process is notable, it might be justifiable as this should be a person's primary direct contribution to marine eutrophication.

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#### Topic Areas

- Infrastructure systems, the built environment, and smart and connected infrastructure , • Sustainable urban systems , • Planetary boundaries

## Session

MS-2 » [Environmentally Extended Input-Output Analysis and Planetary Boundaries](#) (10:00 - Monday, 26th June, Room E)

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