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Ethics, sustainability and the water, energy, food nexus approach – a new integrated assessment of urban systems

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Abstract

Current global developments put increasing ecological, economic and social pressures on urban systems. The density of urban areas concentrates these pressures especially on water, energy and food (i.e., the nexus) resources as if in a 'burning glass'.

The integrated assessment approach is used to frame, study and solve issues such as climate change, water and air quality, land and public health challenges, which are at the core of the approach. To meet these targets, in the last few decades a wide array of assessment tools has been developed. Most of these approaches, however, pursue national or at best regional perspectives and only rudimentarily provide for considerations of local effects. In our integrated assessment approach based on the Nexus City Index we combine an ethical derivation with participatory and accounting tools to grasp and operationalize the complexity of urban areas from a bottom-up and top-down perspective in order to derive a holistic picture of the nexus challenges in urban areas.

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1. Introduction

The Brundtland commission defined sustainability as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs [1]" and thus bases its definition on intra- and intergenerational justice as central human rights principles.

However, today almost one billion people are undernourished, 0.9 billion do not have access to safe drinking water and 1.5 billion have no source of electricity [2-4]. According to current calculations, by 2030 the human demand for water will exceed the foreseen availability of water resources by approximately 40% [2, 5]. Demand for water is expected to grow by 30% to 40%, for energy to grow by 40% to 50%, and for food to grow by 35% to 50% until 2030 [3, 6-8]. In Europe, by 2040 several countries will face significant water stress [9]. This nexus among food, energy and water requires improved management concepts as pressure on demand will further increase in the future: "The urban population in 2014 accounted for 54% of the total global population and it is estimated that by 2017, even in less developed countries, a majority of people will be living in urban area.[b]" Today, 827.6 million people live in slums and often lack adequate water and sanitation services. This number will likely increase to 888 million in 2020.[c] And, already today, "cities account for two-third of the world's overall energy consumption.[d]" These figures well exemplify the increasing pressures on the discussed nexus sectors anchored in different, but interdependent, dynamics of global and regional change [3]. The dynamics encompass a broad spectrum of trends including "demographic changes, urbanisation, industrial development, agricultural modernisation, international and regional trade, markets and prices, technological advancements, diversification and changes of diets, and climate change as well as more context-specific drivers, like governance structures and processes, cultural and societal beliefs and behaviours" [7]. All of these developments result in a growing pressure on limited resources. If current trends continue, the pressures on natural resources and ecosystem services will have far reaching consequences [10] and may "drive social-ecological systems across critical thresholds, e.g., via land degradation, water scarcity or food-crises" [3].

Although the specific effects of population growth will be mitigated substantially by other social and economic factors (as will be discussed below), the increasing population will be a key driver of strain on natural resources: "It is not just about the size of population but also about the way in which people behave" [2]. Roughly half of the population currently lives in rural areas [11]. However, the current urbanization trend especially into megacities will likely continue and thus aggravate challenges like sewage disposal, traffic congestion or air pollution [5]. Domestic and other industrial uses account for roughly 20% of water abstractions. Although the volumes in these sectors are comparatively low, their quality and reliability demands are very high; furthermore, these uses "carry significant weight in deciding how water should be allocated because of their importance for inclusive growth, continuing urbanisation (by 2030, over 60% of the world's population will live in urban areas) and the persistent lack of access to safe drinking water in some regions" [2]. Urban lifestyles offer attractive options, but are generally more resource intensive and consumption and waste production are concentrated and thus pose additional challenges for sustainable city design [3]. Resolving this challenge will require a global framework of justice as one important step towards achieving sustainable development.

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[b] http://www.who.int/gho/urban_health/situation_trends/urban_population_growth_text/en/
[c] UN-water factsheet: http://www.un.org/waterforlifedecade/water_cities.shtml
[d] http://www.worldbank.org/en/topic/urbandevelopment/brief/low-carbon-livable-cities