A missing link - site resource inventories for the circular city

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The concept of the circular city (CC) can be employed to mitigate the impact of the Food-Water-Energy Nexus on the environment at the local as well as the global level. The CC is based on circular economy (CE) ideas, where one of the key elements is coupling: unused and/or waste output of CE-entities can be used as input to other CE-entities. Due to the nature of some CE-entities, they need to be located in the proximity of other suitable CE-entities within the build environment.

Policies and strategies on the level of the EU, city, or district deliver an orientation; zoning law and building codes sets the legal frame when integrating a CE undertaking into the urban fabric. Based on the requirements of a planned CE-entity with a known configuration at a given location, comprehensive information is needed (1) on the infrastructure available, (2) where other usable CE-entities are situated, and (3) which qualities and respective quantities they offer. This may be, to name few, separate sewerage equipped buildings able to deliver grey water or facilities with excess heat on the output side; or entities which accept organic waste as input, e.g. biogas plants.

A site resource inventory using different data would unveil urban sources available on a given site to support business location decisions. One data source for a site resource inventory is the geodata infrastructure maintained by the authorities, e.g. the Berlin Geodata Portal. Information is centrally collected and published; but that comes with some restrictions: a rather fixed information structure, low update rate, and no means for user conducted error corrections. A further data source is volunteered geographic information as provided by OpenSteetMap (OSM), where every user can add and change content. OSM relies heavily on tags which describe specific features of map elements, but the standard tags of OSM are of only little use for the CC. Recently an ongoing project on OSM improve the semantic granularity by the introduction of specific CE-tags. This CE-project puts the main focus on locations. But there is further need for extending the range of the tags to enable CC siting by supporting attributes of CE-entities with regard to their material flows.

The CC food sector and likewise urban agriculture (UA) bears potential towards sustainability if resource efficient food production technologies are used as CE-entities such as aquaponics, the coupled production of fish and vegetables.

Agriculture In the rural environment often uses single-story buildings which are inappropriate in urban contexts where low land consumption is required. On the next level, the roofs, there is
much unused space available but competing claims are made, such as green roofs, recreation, housing, thermal and photovoltaic solar use as well as UA solutions like greenhouses. Urban aquaponics as a CE-entity is used exemplarily to propose OSM tags which can evolve to a CE tagging system - thus manifesting a new geodata management approach for a circular city.