

Wastelands and circular economy: landfills as a reused, "recycled" or restored space

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In 2014, European Commission introduced the concept of circular economy as a vision for a more sustainable approach of living and development towards a climate-neutral and a zero-waste economy (COM(2014) 398). In the past decade, different theories on the levels of circularity (Breteler, 2022) have been developed for the tackling of climate change, biodiversity loss, pollution and waste. All of them have as a common goal to prologue the life of any material or product and to reduce waste disposal in landfills at the end of their lifecycles.

The five-step pyramid of waste hierarchy, introduced in 2008 from the Waste Framework Directive of European Union, including waste prevention, reuse, recycling, recovery (including energy recovery) and safe disposal got inverted with the aim of waste reduction and making clear guidelines to the state countries that sending waste to landfills is the last option (2008/98/EC, Article 4). The goal is to reduce landfilling of municipal waste to 10 % till 2035 (1999/31/EC, Article 5/5). Even if nowadays in some countries bio-waste is not part of the sustainable landfilling practice, research show that 90 % of the more than 500.000 Europe's landfills are non-sanitary (EURELCO, 2021) and will have to be restored as a priority on the protection of the environment and human health. In a broader sense and thinking of space in connection to the circular economy concept: should landfills be seen as spaces to be re-used, "recycled" or restored that start a new lifecycle carrying a different function than disposal and "digestion" of waste?

Materials for this paper is the investigation on landfills either sanitary or non-sanitary with case studies in Greece, Italy and Germany, a research for the doctoral project "From Wasteland to Landscape". The research methodology is based on the Research through Design (RtD) or Research by Design (RbD) method (Roggema, 2016), quite similar to the method of Design Science in sciences. It consists out of a pre-design, design and post-design phase with no strictly definition of sequence in time and duration. An interweaving of each phase with the other occurs in practice.

For the tackle of complex design problems, known as "wicked problems", "looseness" and "openness" are needed, so that public participation and media attention is allowed. According to Roggema (2016), RtD responses to the question on "how research could emerge through design" and "how new knowledge can be harvested by using methodologies and processes of designing". Even though for the purposes of this paper, parts of the pre-design and design phases will be presented, a short description of each phase will be given. Specifically, the pre-design phase consists out of research and collection of data around waste and their disposal, as well as visiting of landfills in different stages of "digestion" (active, closed in or after the post-management period) and facilities working on waste management. Secondly, the design phase consists out of the creation of diagrams of analysis, toolboxes of planning strategies and creation of designs. Finally, main focus of the post-design phase is to communicate the produced information to the wider public aiming "to create an artefact with intended goal of societal change" (Roggema, 2016).

Wastelands are categorized to the grey infrastructure typologies, since they are clearly man-made landscapes. As reconvered quarries, they can be transformed into green infrastructure typologies, regaining ecological and social value (Talento et al., 2020). Landfills with hazardous, non-hazardous and with inert materials are the three types of landfills in Europe (1999/31/EC, Article 4). According to Cocoon Interreg Europe (2021), 20% of Europe's landfills contain hazardous waste and the rest 80 % contains municipal solid waste. Countries with heavy industry this kind of landfills, such as Germany, Estonia (Eurostat Statistics Explained, 2023). Researching, analysing and documenting with the production of diagrams, such as landfills in section, the lifecycle of a landfill, the evolution of landfill over time and a typological research of them (non-sanitary, sanitary and sustainable) resulting from the landfills visited in Italy at the Gruppo Veritas S. p. A. in the Metropolitan Area of Venice, in Greece at the FODSA of Larissa and of Central Macedonia and parks in Germany (Olympia Park Munich, Allianz Arena Munich, debris hills or rubble mountains; Olympia Berg in Munich, Spoil Tips; Monte Kali in Heringen), a map of strategies of restoration of landfills in the urban and landscape morphology results, depending on various factors, such as their material content and the surrounding area. Taking in consideration the above referred factors and that landfills after their post-management period - having come to the end of their lifecycle and fulfilling its scope-, they may be "re-used", "recycled" or "recovered" in spaces with new functions starting a new lifecycle.

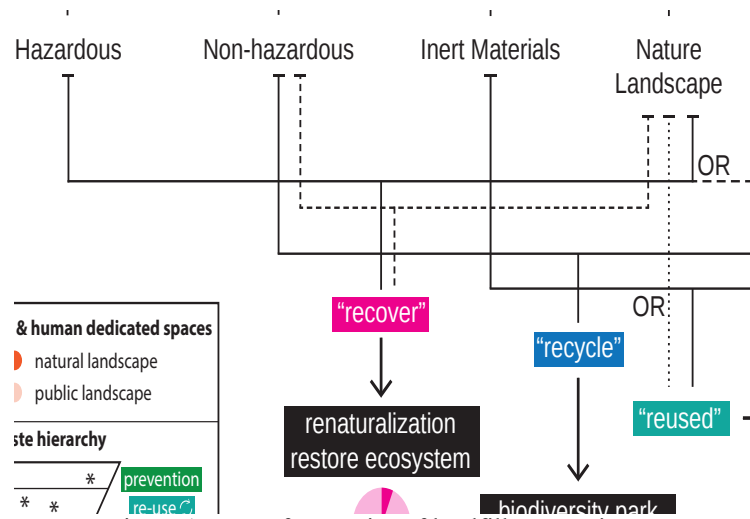


Figure 1. Map of strategies of landfill conversion

Each wasteland is a special case on its own and require individual documentation, mapping and analysis of its characteristics and relationship to the surrounding; in the best case with several visits for further observations. Scenarios through time with a variety of design solutions should be created. Note that more than one best design solutions can apply to one location. As a conclusion, wastelands are considered as part of the circular economy being the last station in the waste generation chain, but after their closure, post-management ("digestion" and "drying out") period is completed, they can be "recovered" through re-naturalization or natural attenuation, "recycled" as a space that restores biodiversity and can serve as an energy landscape where social interaction can take place or "reused" as open public space for social and education activities.

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