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Interactive comment on "Constructed Technosols are key to the sustainable development of urban green infrastructure" *by* Maha Deeb et al.

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We thank the reviewers for their comments on the manuscript. We have addressed all of their comments as described below, and feel that the manuscript is greatly improved as a result. Below, the reviewer's comments and our responses follow directly below each comment:

Reviewer #1, "When you are writing a review article on constructed soils, one would expect an overview of results/findings/suggestions for your suggested categories: 1. Constructed Technosols for parks and squares with lawns 2. Constructed Technosols for developing tree-lined streets 3. Constructed Technosols for stormwater management 4. Constructed Technosols for urban farming 5. Constructed Technosols as a

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solution to reclaim derelict land I couldn't detect any table or figure describing which ranges of soil properties (chemical, physical and biological) occur or should have and why."

The reviewer brings up an important expectation that we have long discussed but have been unable to resolve. Below we describe why the search for specific "recipes" for constructed Technosols is difficult and highlight relevant information that is present or has been added to our paper: âĂć As is noted in the paper, the only mathematical model for chemical-physical soil fertility for Technosols was developed in France (Rokia et al., 2014) and was based on comparison of soil fertility characteristics with natural soils. This example provides the information (soil physical and chemical characteristics) the reviewer asked for, but it only addresses one process and does not integrate different contexts, other types of waste, or biological fertility. âĂć In section 3.1, we provide guidance for the choice of substrates based on given criteria and limitations that may occur. However, even here, variance in international norms and access to different substrates poses a great challenge to developing a widely applicable formula. Moreover, one of the objectives of this paper is to encourage readers to adapt to available waste types and by-products, their country's regulations, native biotic factors, desired land use functions, and to highlight the importance of design planning. âĂć Even with one or two specific types of local waste, different formulas are needed for different land uses, For example mixing two types of waste, such as excavated deep horizons with compost, can have several applications for different land uses. While a mix of 30% compost with 70% excavated deep horizon to a depth of 30 cm would be applicable for parks and urban farming, this mixture could also be applied to much deeper depths (1 – 2 m) for tree-lined streets, or below a 5 cm layer of organic mulch to avoid evaporation and conserve water in dry areas. More generally, given the same waste materials, the ratio of compost used will vary greatly depending on the quantity of water received from precipitation. While 20% compost is suitable for open parks in temperate areas, 40-50% compost is needed in dry areas.

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Why these groups, what is the reason i.e. background to distinguish five substrates, where are overlappings? (1 and 2?)

We have added the following paragraph (line 160) to the “Methods” section to justify our choices of land uses. “Five land use were chosen for this review based on the land use classification and evaluation provided by Panduro et al.(2013) that included 8 land uses: parks, common area apartments, common area houses, sports fields, agriculture fields, green buffers, nature, lakes. We merged the first three land uses into a single group: “parks and squares with lawns” assuming that these would create similar conditions for the use of constructed Technosols. Sports fields were not included as they have already been discussed in literature (Puhalla et al., 1999). Nature and lakes were excluded as the application of constructed Technosols is not needed in these land uses. Degraded land and tree lined streets were added as complementary independent categories because they are commonly present in urban areas.” Consequently, the title of section 3.2.3 has been changed to “Constructed Technosols: Green buffers for stormwater management.

Describe and summarize the scientific progress made during the last 10 years.

Text describing scientific progress made during the last 10 years was added to the Conclusion (before line 435): “Constructed Technosols can contribute to sustainable environments in urban contexts as they supply multiple functions and services in several land uses. Over the past ten years, studies have confirmed the value of mixes that included organic material for soil fertility. A dominant theme that has emerged over this time is mixing excavated deep horizons with organic waste due to the constant need to recycle and repurpose excavated deep horizon waste. Mixtures containing small ratio of natural soils have also been shown to increase the colonization rate of macrofauna. A dominant conclusion that has emerged is that coupling the choice of waste mixture ratios and plants leads to a greater positive impact on soil functions than the choice of waste mixtures alone.”

Describe the way from science to practice: which substrates are well accepted and used which not and why In addition,

We have added some text about acceptable substrates to the Conclusion section. “Over the past ten years, studies have confirmed the value of mixes that included organic material for soil fertility. A dominant theme that has emerged over this time is mixing excavated deep horizons with organic waste due to the constant need to recycle and repurpose excavated deep horizon waste”. We note that no substrates were rejected based on the conditions listed in section 3.1.2 (Use of waste materials in constructed Technosols). Even low ratios of substrates (i.e., 10% compost with 90% excavated deep horizons) could be used as a B horizon.

I suggest giving a statement on the two questions: 1. are environmental acts limiting factors to produce and use technogenic substrates? 2. what’s about plastic and the acceptance of these substrates in the last years?

We have added the following text on “environmental conditions” to the Conclusions section (line 440): “However, this study confirmed that each element used in the formula to design constructed Technosols should be carefully considered. These elements include the ratio and the composition of waste, the order of horizons, environmental conditions, the choice of plant species, the implementation methods, and the critical need to foster pedogenic processes, especially during the first months following construction.” There is already a “limitation” section addressing environmental conditions; 3.1.4 - Technical constraints to consider while constructing Technosols. We note that the topic of legislation is briefly mentioned in several places in the text, mostly from the EU and USA perspective. This hasn’t been a limitation but rather a motivation for the development and use of Constructed Technosols. We have added some text about plastics to section 3.1.4. - Technical constraints to consider while constructing Technosols (line 241): “Microplastics are another source of contamination that should be considered when building Technosols. Although the number of current studies is limited, plastic contamination may negatively affect plant growth, soil organisms, and

human health through integration in the food chain (Horton et al., 2017). Studies show the use of sewage sludge compost as fertilizer increases microplastic contamination in soils (Zhang and Liu, 2018). To prevent microplastic contamination, sewage sludge compost should be avoided in high quantities, only be used in low ratios, and should be tested for microplastic contamination before application."

"Finally, I suggest modifying the title to 'Using constructed soils for green infrastructure - challenges and limitations"' The title has been changed as suggested.

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