1. How much human-made material for a Technosol?

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Abstract:
Over the two last centuries, the rate of disturbances which affect the soils has considerably increased. The modifications affect physical, chemical and biological parameters. Inside an anthropization gradient which is often equivalent to disturbances, soils can be considered as natural soil, anthropized soil or even Technosol. Soils developed on non traditional substrates and largely due to intensive human activity are now referenced as Technosols in the World reference base for soil resources Technosols combine soils whose properties and pedogenesis are dominated by their technical origin. They contain a significant amount of artifacts (something in the soil recognizably made or extracted from the earth by humans), or are sealed by technic hard rock (WRBSR) (FAO, 2006). They are more precisely defined by 20 percent or more (by volume, by weighted average) artifacts in the upper 100 cm from the soil surface. However this 20 percent limit does not reflect the variety of artifact type and intensity of their impact on existing substratum. Depending on both of these parameters (pre-existing substratum and artefact type) pedologic evolution and functioning of the soil may be altered for values much smaller or on the reverse may not be modified for higher artifact contents. The present work aims at confronting this 20% limit to one of soil most common interpretation factor, pH, using a modeling approach. Statistical analysis of a soil database composed of 378 non or slightly anthropized soils (NOSAS) and 338 highly anthropized soils (HAS) has shown that highly anthropized soils can be distinguished based on their chemical properties and a typology based on the nature of their artifacts can be proposed. Among them, concrete appears as one of the most common technical material found in anthropized soils and has then been selected as an example. In a first step, chemical behavior of concrete has been studied and a reactivity model has been proposed with a focus on pH. In a second step, addition of increasing amount of concrete to a natural soil and its effect on pH has been modeled. Reactivity model of the natural soil with regard to pH and based on both buffering capacity and site exchange constants enabled a realistic evaluation of the threshold proportion of concrete effectively altering soil functioning properties.

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