Monitoring report
Iso 14064-2

Project Bonneuil s/Marne - EV

EDAPHOS ENGINEERING

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1 Préamble

According to the Swiss Soil Science Society (SPP), the topsoil layer is "the outermost layer of the Earth's crust, characterized by the presence of numerous living organisms. It is the site of intense exchanges of matter and energy between air, water, and rocks. As an element of the terrestrial ecosystem, soil plays a key role in global material cycles."

It has long been known that topsoil is also one of the world's primary carbon sinks and plays a major role in combating climate change.

Since the UNFCCC-COP21 in Paris in December 2015 and the official recognition of SOC sequestration in the UNFCCC process in 2017, soil organic carbon (SOC) concentration has been considered a promising means of creating new carbon sinks or enhancing pre-existing ones through a multi-impact approach (Bossio et al., 2020). Increasing organic carbon content generates numerous co-benefits, such as improving biodiversity and ecosystem services, reducing soil erosion risks, enhancing agronomic productivity through improved nutrient and water retention capacity, and improving soil, plant, and animal health.

The retention time of sequestered carbon in the soil can range from short-term—particularly in the case of organic amendments—to long-term storage (millennia) (Lal et al., 2015), especially in situations where carbon is barely available.

The production of topsoil through an engineering method ("pedological engineering") can thus be considered a promising approach in the fight against climate change.

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2 Pedological engineering

In nature, the formation of the topsoil is a long and complex process involving physical, chemical, and biological phenomena.

The soil matrix is the product of the alteration of the parent material (bedrock, fill, colluvium, etc.) and the degradation of organic matter. This mixture of mineral and organic matter occurs along a vertical axis, from which the soil extends in depth. Strong bonds form between mineral and organic particles, primarily under the action of living organisms. Microorganisms (bacteria and fungi), invertebrates (insects, mites, earthworms) and plants structure the soil by producing organic-mineral aggregates rich in nutrients. In these aggregates, SOC is generally fixed in a very stable form and will not be released into the atmosphere for decades or centuries. The alteration of minerals in depth and the mixing with humus on the surface continue and result in the formation of a deep soil profile with a hierarchy of successive layers, known as soil horizons.
In nature, a soil with different horizons is the result of a very long process that can take up to several thousand years. Consequently, a fertile natural soil is a non-renewable resource on a human scale. Fertile soils are nevertheless essential at both a local and global scale to meet the challenges of food security, water filtration, environmental protection, carbon storage, and urban greening. Very large volumes of fertile soils will be needed in the coming decades to meet these challenges. However, as fertile soils are non-renewable resources and their stock is limited, alternative solutions must be found to avoid degrading the environment of one site to benefit another (for example, using arable land from agricultural areas for urban greening).
Soil engineering allows the use of sterile mineral materials to create fertile and functional (techno)soils for agricultural, forestry, or landscaping purposes.
This innovative process is based on the science of soil formulation, combining mineral, organic, and microbial elements. The objective is to replicate the natural processes of soil creation but to accelerate the process through specific work on key mechanisms in order to create fertile soil in a few months rather than centuries or millennia.
Soil engineering can supplement natural resources to meet human needs and contribute to the rehabilitation of areas where the supply of natural topsoil is uncertain or impossible. In this process, fertile soils are created from sterile soils.
Sterile soils naturally contain little or no organic carbon and only traces of elemental carbon. By creating fertility from sterile materials, the stocks and nature of SOC could be significantly improved. The main challenge of soil engineering is therefore to create stable forms of carbon using the mechanisms that make soils fertile.
As a result, the new fertile soils created can be considered a new type of carbon sink with multiple impacts

3 Non technical summary

This document is the follow-up summary of the GES project. Approximately 22’000 tons of topsoil have been created in the 2021-2024 period with the methodology described above.

4 Project description

4.1 GES

4.1.1 Project details

Projet : GES
Site : Ile de France – Bonneuil sur Marne
GPS Coordinates : details on demand

Third party : details on demand
Adress : details on demand

Project reference (Internal) : FRISD2023107

Project manager : HRA (Edaphos Engineering SA)
Project supervisor: MPI (Edaphos Engineering SA)

4.1.2 Project summary

Objectives and expectations : Soil engineering is employed to enhance the soil's biotic component and facilitate the use of depleted earth materials in urban greening projects.

Monitoring methods: Agronomic analyses are conducted to guarantee the quality of the valorized materials. These analyses are performed on a routine basis every 5,000 tons.

4.1.3 Environmental impact

a) ***Circular economy*** : This project has enabled the creation of a resource (fertile soil) from sterile mineral waste (excavation materials) that was initially destined for landfill or very poor soil.

a) ***Soils and climate*** : Regarding climate, the project has reduced greenhouse gas emissions through the use of local resources and the elimination of long-distance transportation of natural materials. Additionally, carbon sequestration processes enabled by soil engineering have resulted in a reduction of hundred tons of CO2 equivalent. Lab report can be delivered on demand.

4.1.4 Project illustrations

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