Biochar, a material produced through the pyrolysis of biomass and waste, is a promising tool in combating soil contamination with heavy metals and reducing greenhouse gas emissions. It holds the potential to play a pivotal role in the circular economy by transforming waste into high-value products.

Of particular interest is biochar derived from municipal sewage sludge, which is readily available and rich in nutrients. However, biochar produced solely from sludge may be less effective in immobilizing heavy metals and may contain contaminants. The solution lies in co-pyrolysis, which combines sewage sludge with other materials, such as agricultural or forestry waste, to produce a material with enhanced physicochemical properties.

The project focuses on evaluating the impact of biochar from the co-pyrolysis of sewage sludge with agricultural and forestry waste on soil properties, the ability to immobilize heavy metals in the soil-plant system, and interactions with the soil microbiome. Special attention will be given to analyzing the variability of biochar's effects across seasons to understand how environmental factors such as temperature and humidity influence the structural stability and composition of biochar. A key aspect of the research includes examining the potential leaching of contaminants (e.g., PAHs) from biochar into the soil, as well as biochar's capacity to reduce greenhouse gas emissions and sequester carbon. Experiments under field conditions will help determine whether biochar from the co-pyrolysis of sewage sludge can serve as a multifunctional material for remediating soils contaminated with heavy metals.

This project aligns with global sustainable development goals, offering innovative solutions for environmental and climate protection.