Title: Tracing carbon in landfills

Decomposition of organic waste deposited in landfills is a global source of anthropogenic greenhouse gases (GHG). While landfill gas (LFG) emissions are decreasing in many developed countries, emissions in developing countries are increasing rapidly. Many landfills are poorly documented, and large uncertainty exists about the type and amounts of waste that has been deposited historically and their current LFG emissions. Various techniques have been applied to quantify direct CH_4 emissions from the surface of landfills; however, techniques with highest spatial resolution are very time-consuming and difficult to scale up to the whole site while techniques integrating fluxes over large areas are challenged by variable topography and interfering CH_4 sources and rely on accurate micrometeorological models to estimate the footprint of the measured fluxes.

This PhD project aims to advance possibilities to estimate LFG production and remaining degradation/production potential in landfills by combining recent developments in field measuring techniques (rapid soil flux measurements using high-sensitivity laser-based spectrometers) with stable isotope techniques. The new data will be interpreted in terms of landfill degradation status, gas production, spatial distribution within a landfill and migration processes. The specific objectives are:

- To establish stable isotope markers in gaseous and liquid efflux as proxies for estimating the remaining production/degradation potential
- To develop a methodology for rapidly quantifying landfill emissions and cover soil CH_4 oxidation efficiencies at landfill scale
- To use the improved understanding of landfill processes together with the improved methodology for surface mapping to develop a methodology for estimating the remaining degradation potential of a landfill site based on “easy to measure” parameters