Intersecting Hazards
Impact of <u>PF</u>AS on antimicrobial <u>re</u>sistance spread in sludge-fertilized <u>s</u>oil
(IMPRESS)

The growing use of sewage sludge as fertilizer in agriculture brings more than just nutrients to the soil—it also introduces a complex mix of pollutants. Among them are PFAS (per- and polyfluoroalkyl substances) and antibiotics, both known for their persistence and potential to disrupt ecosystems. Early studies suggest that these substances may work together to accelerate the spread of antibiotic resistance genes (ARGs), posing a serious risk to both environmental and human health.

The IMPRESS project aims to uncover how PFAS influence the development and spread of antibiotic resistance in soils treated with sewage sludge. Using cutting-edge techniques—including mass spectrometry, DNA sequencing, and gene expression analysis—scientists will investigate how these pollutants affect soil microbes and resistance genes. The experiments will be conducted in greenhouse environments using soils from the Łódź region of Poland and sludge from four wastewater treatment plants of varying sizes. The sludge will be applied at legal agricultural doses and enriched with PFAS at levels reflecting real-world contamination.

The research will be performed by a multidisciplinary team from the University of Lodz, the Medical University of Warsaw, and the New York State Department of Health (USA), on a following aspects: measuring PFAS and antibiotic levels, tracking how antibiotics break down in the presence of PFAS, analyzing microbial diversity and community composition, profiling resistance genes, and finally integrating all data using advanced statistical and machine learning tools.

IMPRESS project is uniquely positioned to provide the first in-depth look at how PFAS and sewage sludge interact to influence the fate of resistance in soil. The findings will support better risk assessment and inform policies on biosolid use, contributing to safer agricultural practices and aligning with the global One Health approach that links human, animal, and environmental health.