



Symphonies in Soil: Harnessing Ecoacoustics to Monitor Soil Communities

Alex F. Taylor (1), Jake M. Robinson (1,2), Amy Annells (1), Timothy R. Cavagnaro (1,2), Nicole Fickling (1,2) Craig Liddicoat (1,2), Xin Sun (3,4), Martin F. Breed (1,2)

- (1) College of Science and Engineering, Flinders University, Bedford Park, SA 5042, Australia
- (2) The Aerobiome Innovation and Research Hub, College of Science and Engineering, Flinders University, Bedford Park, SA 5042, Australia
- (3) Key Laboratory of Urban Environment and Health, Ningbo Observation and Research Station, Fujian Key Laboratory of Watershed Ecology, Institute of Urban Environment, Chinese Academy of Sciences, Xiamen, China
- (4) University of Chinese Academy of Sciences, Beijing, China

ABSTRACT

Soil ecoacoustics is an emerging field and suite of tools that use acoustic and substrate-borne vibrations to characterise belowground biological activity and ecological processes. Integrating approaches from bioacoustics, biotremology, and soil science, this framework offers a minimally invasive means to investigate soil communities and assess soil health. Despite rapid progress, key challenges remain—particularly in understanding how soil properties affect sound propagation, distinguishing biotic from abiotic signals, and developing standardised methodologies. Here, we outline the potential of soil ecoacoustics to advance knowledge of belowground ecosystems and propose its use as a powerful, non-invasive tool for soil health monitoring and management.