

Soil microbial activity in deep soil profiles

Zhi Liang, Jørgen E. Olesen, and Lars Elsgaard

Department of Agroecology, Aarhus University

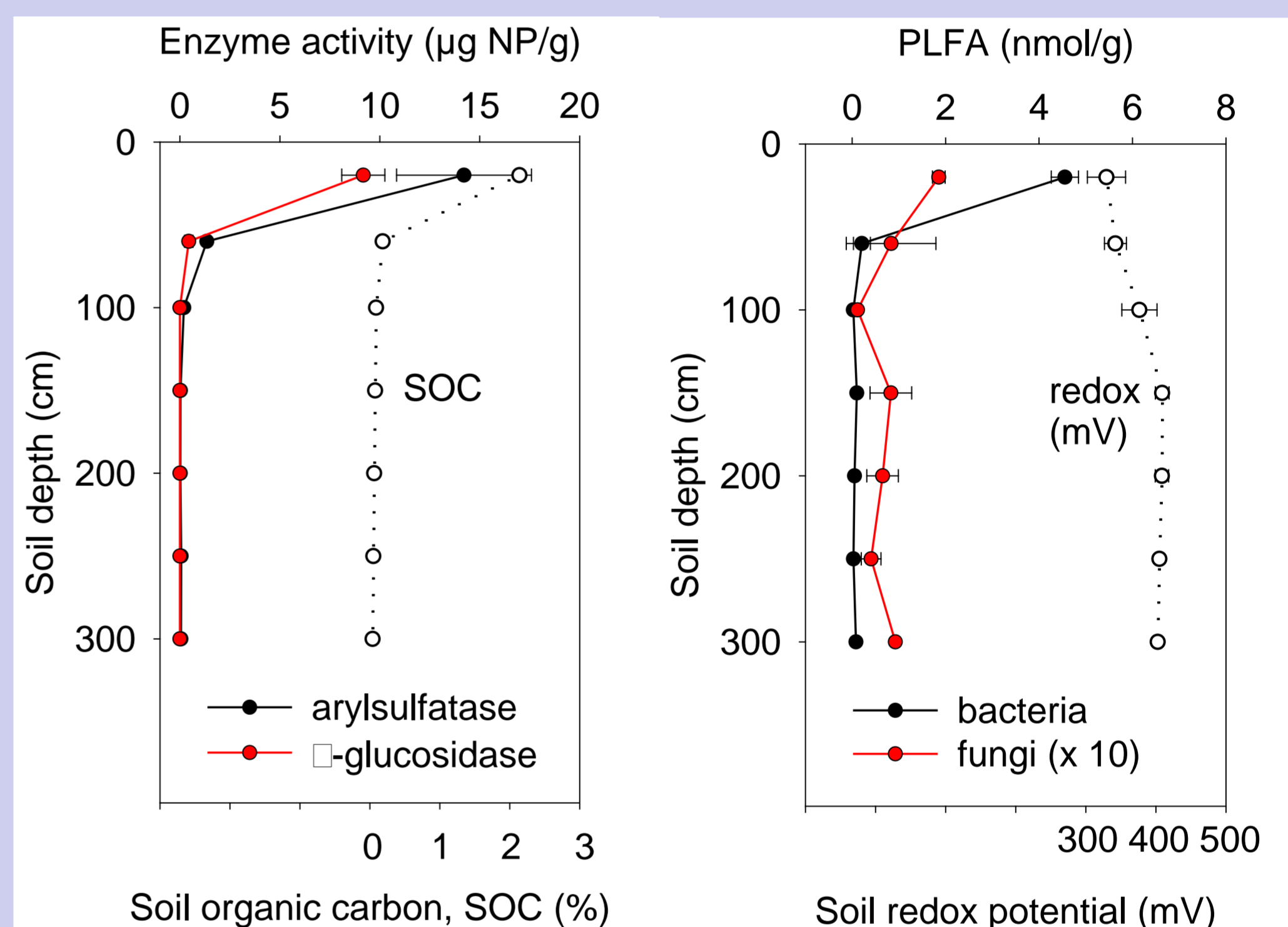
INTRODUCTION

- Deep mineral subsoils (>100 cm) generally have a low concentration of soil organic carbon (SOC), but due to their immense volume, subsoils hold the majority of the global SOC pool. Hence, subsoils play an important role in C sequestration, which may counteract atmospheric CO₂ increase.
- Microbial activity is the main cause of turn-over of C compounds in soil ecosystems. However, the quality of SOC in subsoils is usually poor and is limiting microbial activity. Input of fresh C material from deep root growth may stimulate microbial activity in subsoils and thereby also increase the decomposition of the low-quality subsoil SOC eventually leading to increased CO₂ emission.
- In the present study we test how root-derived C compounds are turned over by microbial activity and to what extent there is a feedback on the subsoil SOC (enhanced decomposition). The first part presented here is a characterization of native microbial biomass and activity in a 3.2 m deep soil profile developed on a cultivated grassland.

MEASUREMENTS INCLUDE

- Soil texture, redox potential, pH, total C and total N
- Extracellular enzyme activity
- Microbial signature fatty acids (PLFA)
- Basal and substrate-induced respiration (CO₂)
- Molecular biomarkers

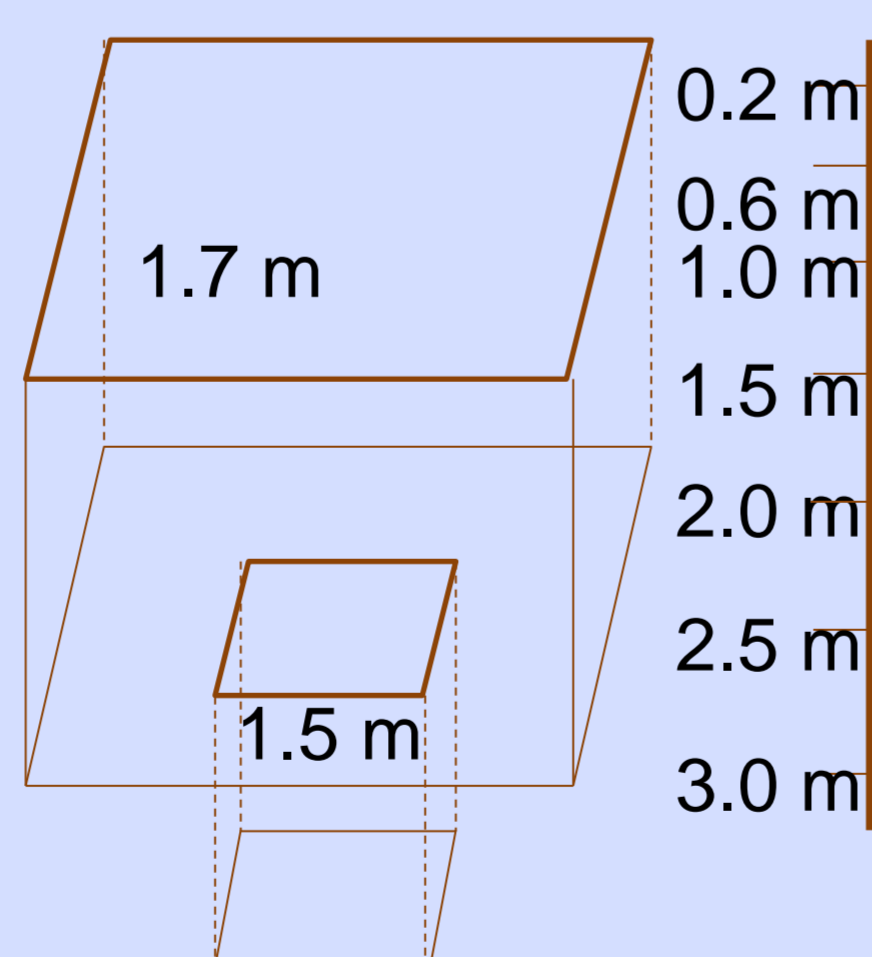
RESULTS



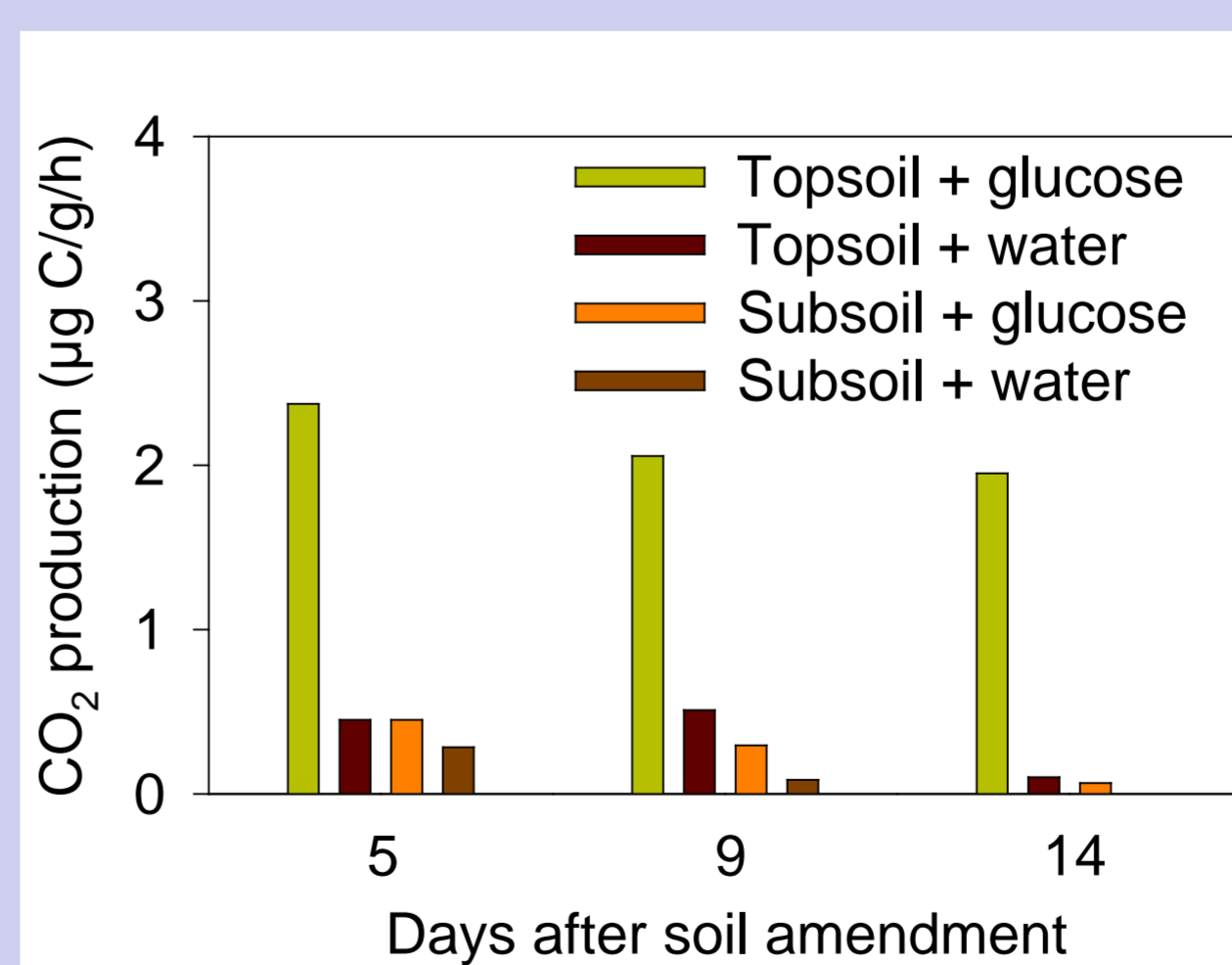
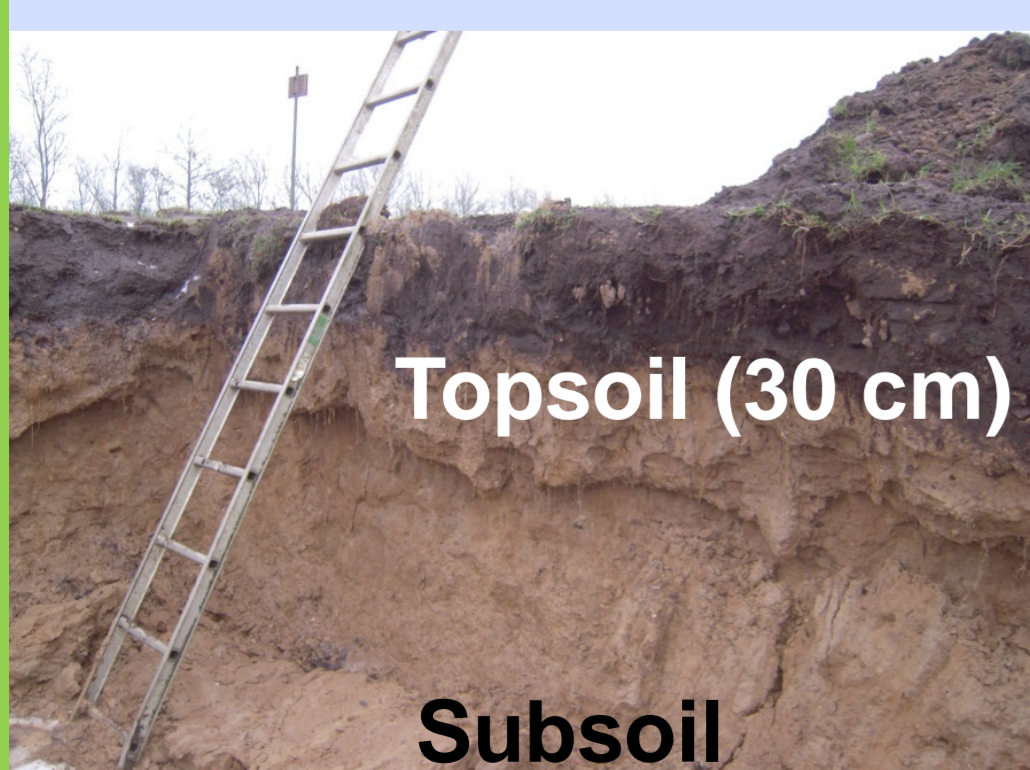
Left: Enzymatic activities and SOC.

Right: PLFA biomarkers of bacteria and fungi, and soil redox potential. Fungal PLFA is multiplied by 10.

SOIL PROFILE SAMPLING



Soil was sampled at 7 depths from a 3.2 m deep soil profile at AU Foulum. SOC ranged from 2.1% in topsoil to 0.04% in subsoil.



Microbial activity (CO₂ production) in topsoil and subsoil with or without added glucose (water as control). Respiration rates were measured 5, 9 and 14 days after the amendments.

Results show that microbial activity and indicators in the native subsoil are much lower than in topsoils. Incubation studies on stimulation of subsoil microbial activity by adding different root materials are ongoing.