Seeing earthworms in the dark - Spatial mapping of biological activity in soil

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As ecosystem engineers earthworms play a vital role in modifying soil habitats and modulating the availability of resources to other soil fauna. Their behaviour is crucial to providing healthy soil and the provision of many of the ecosystem services on which humans depend. However, to fully understand the interaction between ecosystem services, soils, earthworms, and other organisms requires observation of organism behaviour directly; something which is currently inhibited due to an inability to track real-time invertebrate movement in soils.

To address this problem we have developed an affordable non-invasive system for tracking earthworm movement in soil. This passive acoustic system uses single low-cost piezo-electric transducers or accelerometers for the detection of invertebrate activity in soils; these single sensors can also be configured as multiple sensor arrays and used for triangulation and tracking of invertebrate movement. This system can be used to test a variety of hypotheses relating to soil-dwelling invertebrates such as whether movement follows diurnal cycles or is driven by gradients of soil properties such as organic matter, moisture, density and pH.

In this session we will present results from the different sensor types (vibration, piezo-electric, and accelerometer) when used to detect earthworms, and other invertebrates such as cockchafer larvae, in a range of soils. We will also discuss how the single sensors are used in multi-sensor arrays for real time tracking of soil invertebrates using low cost microcontrollers, and single board computers for data acquisition, signal processing, data flow, and data analysis.