New research unlocks subsurface secrets in Avon River Critical Zone

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A study led by The University of Western Australia has revealed new insights into the landscape profile of the Avon River Critical Zone Observatory in Western Australia.

Ph.D. candidate Jessie Weller, from the UWA School of Agriculture and Environment and the Center for Water and Spatial Science, was lead author of the study published in *Earth Surface Processes and Landforms*.

The Critical Zone is the thin layer of Earth's surface where rock, soil, water, air, and living organisms interact, playing a vital role in processes such as water filtration, nutrient cycling and soil formation.

Researchers used geophysical surveying techniques; electrical resistivity tomography and passive seismic horizontal-to-vertical spectral ratio to map the deeply-weathered clay soil.

The study revealed subtle differences in deposits and soil layers and horizons while also determining the bedrock depth using ambient seismic noise.

"The two methods we used in the study revealed a detailed subsurface profile of the region," Weller said.

The clay soil of the landscape is frequently studied geochemically due to its economic value—particularly for bauxite, nickel and cobalt extraction—but is underexplored in terms of its impact on agriculture and sustainability.

The research highlighted the landscape variability and showed how vegetation, weathering and erosion processes shaped the land.

"These types of landscapes are incredible archives of past climates and tectonic activity, and uncovering the stories hidden in their layers can help us better predict and prepare for future environmental changes," Weller said.

"This work highlights the potential of non-invasive geophysical

techniques to shed light on these underexplored systems and their environmental significance."

The findings offer insights into sustainable land management and environmental conservation, particularly to address soil degradation and waterlogging, key challenges for agriculture in the region.

More information: Jessie Weller et al, Combining electrical resistivity tomography and passive seismic to characterise the subsurface architecture of a deeply weathered lateritic hill within the Avon River critical zone observatory, *Earth Surface Processes and Landforms* (2024). DOI: 10.1002/esp.6026

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