



CEPHaS Project Briefing

No.3 November 2018

RECENT ACTIVITIES IN SHALLOW GEOPHYSICS

The CEPHaS project is a joint undertaking between colleagues in Zambia, Zimbabwe, Malawi and the UK to strengthen our shared capacity in order to study how conservation agriculture (CA) practices affect the behaviour of water in soil, crop and groundwater systems.

Important questions are: how does conservation agriculture affect the movement of water from the topsoil, where roots are active, to the groundwater below? And does CA reduce or improve the recharge of groundwater? These questions are important because many communities depend on groundwater, but no one has been able to answer them directly. We are therefore using novel technology called time-lapse electrical resistivity tomography (ERT) to make images of water in the ground at depth. Developments in this technology will allow us to link measurements of soil water and observations of groundwater in boreholes and 'fill the gaps' between the two.

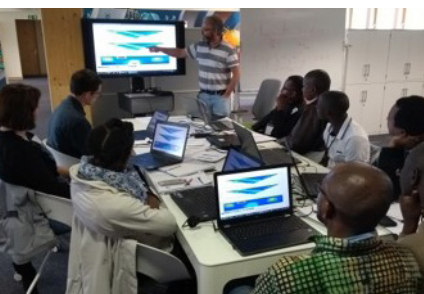


Figure 1 Training in shallow geophysics at the BGS offices in Nottingham.

TRAINING AND KNOWLEDGE EXCHANGE ACTIVITIES

Specialist training in near-surface geophysics has taken place during a focused, four-day training course in Nottingham in the UK (*Figure 1*) and through knowledge exchange activities at the first two project meetings in Lusaka and Lilongwe. The training has included classroom-based lectures, guided installation design activities, laboratory practicals and field-based learning. A key element of the training has been the collaborative assembly and installation of the new monitoring equipment and sensors at the field sites, which has involved all of the partner organisations (*Figure 2*).

FIELD SENSOR INSTALLATION

Installations have taken place at both Liempe Farm in Zambia and at Chitedze in Malawi during June and July 2018. The Liempe experiment is newly established and comprises four replicates of a conventional maize crop alongside CA maize/soya bean intercrop. The experiment at Chitedze has been running for many years and comprises a greater range of CA treatments, again with four replicates. Both sites are now equipped with a network of geophysical sensor arrays (*Figure 3*) and monitoring instrumentation, linked to wireless telemetry for remote measurement control and data retrieval. We acquired the first monitoring data from the Chitedze site during October 2018 (*Figure 4*). By continuously repeating such measurements, we will be able to focus on resistivity changes over time. Assuming that the soil composition doesn't change, this will allow us to map the soil moisture dynamics, e.g. during infiltration and groundwater recharge.



Figure 2 Monitoring equipment installation at Liempe Farm near Lusaka. The PRIME monitoring instrument is being connected to sensor arrays that have been installed within the CA experimental plots.



Figure 3 Sensor installation in boreholes at the Chitedze site near Lilongwe. Arrays of sensors are being lowered into hand-augered boreholes.

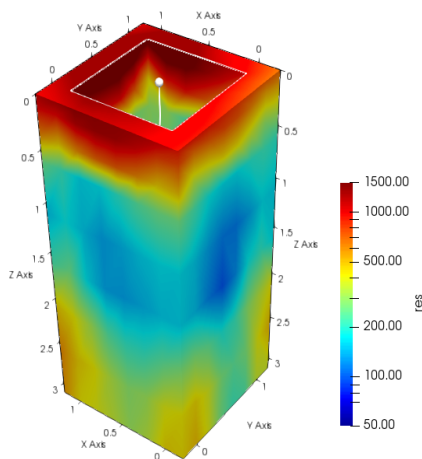


Figure 4 Initial monitoring results from Chitedze. The image shows a very dry, high-resistivity surface layer (red), and compositional changes indicating a transition from higher (blue) to lower (orange) clay content towards the base of the image.

ONGOING ACTIVITIES

Researchers from the University of Zambia and the Lilongwe University of Agriculture and Natural Resources are now beginning to populate a wiki manual detailing the design, installation and operation of the geophysical monitoring stations based on their experience acquired during the first two installations.

Planning is currently underway for the third geophysical monitoring station at the Domboshawa experiment in Zimbabwe. Co-design of the installation with project partners was initiated at the recent project meeting in Lilongwe and is ongoing.

WHO ARE WE?

We are soil scientists, agronomists, hydrogeologists, geophysicists, statisticians and agricultural economists from the University of Zimbabwe, the University of Zambia, Lilongwe University of Agriculture and Natural Resources, the University of Nottingham, Rothamsted Research, Liverpool School of Tropical Medicine and the British Geological Survey. We are also joined by Kasisi Agricultural Training Centre as an NGO partner.

Together we constitute a unique multidisciplinary team with a wide range of experience, including in capacity strengthening.

OUR PARTNERS

We are working with the Zambian Agriculture Research Institute (ZARI), the Department for Agricultural Research Services (Malawi), and our commercial partner, Delta-T Devices (UK).



UK Research and Innovation

HOW CAN I FIND OUT MORE?

- Contact your appropriate country lead (see below).
- Contact the principal investigator (see below).
- Look out for opportunities to attend project stakeholder workshops.
- If you wish to subscribe to this series of project briefings, please contact the principal investigator by email.



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