



CEPHaS Project Briefing

No.4 December 2018

RECENT ACTIVITIES IN HYDROGEOLOGY

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

Many people in Africa depend on groundwater, so the process by which it is replenished ('recharged') is very important. However, little is known about how CA practices affect recharge. Does increased infiltration of water into the soil promote recharge, or does improved water retention in the root zone of the soil increase losses of water? Hydrogeologists in the CEPHaS team want to answer this question by comparing how recharge happens under CA and conventional farming. They will do this by measuring the variation of groundwater levels over time, using specially-drilled boreholes, and by studying the chemistry of the water to understand its sources.



Figure 1 Set up at Domboshava Training centre (DTC), Zimbabwe.



Figure 2 Set up at the Liempe research site in Zambia.

ESTABLISHMENT OF GROUNDWATER OBSERVATORIES

During 2018 the CEPHaS groundwater team engaged in careful planning of how and where to install groundwater observatories linked to other CEPHaS observations. Installations took place at study sites in Zimbabwe and Zambia during November 2018.

Figure 1 shows the drilling at the Domboshava Training Centre (DTC) in Zimbabwe, with steel sheets and plastic covers to minimize compaction of the soil and to keep borehole water off the plots. **Figure 2** shows a light-weight drilling rig in use at the Liempe Farm experimental site in Lusaka, Zambia.

The installation of the boreholes was supervised by members of the CEPHaS groundwater team from the British Geological Survey and from University of Zambia or University of Zimbabwe, and members of the other CEPHaS teams were invited to visit the site. Installation of the boreholes serves as 'on-the-job' training in the CEPHaS project. The establishment of monitoring boreholes requires particular care, and groundwater staff as well as the drilling teams were trained in details such as how to complete the borehole correctly, the installation of additional monitoring equipment, and programming and installation of data loggers for observation and recording of the water table fluctuations.

GROUNDWATER OBSERVATORIES

At DTC in Zimbabwe two monitoring boreholes were installed in plots under CA and conventional management. A pumping borehole



Figure 3 Installation of monitoring equipment at Domboshava Training Centre near Harare. The WIN-SITU data loggers are recording water level fluctuations in the borehole at 30-minute intervals throughout the lifetime of the project.



Figure 4 The GetWet Drilling team (drilling contractor) at the Domboshava Training Centre in Zimbabwe.

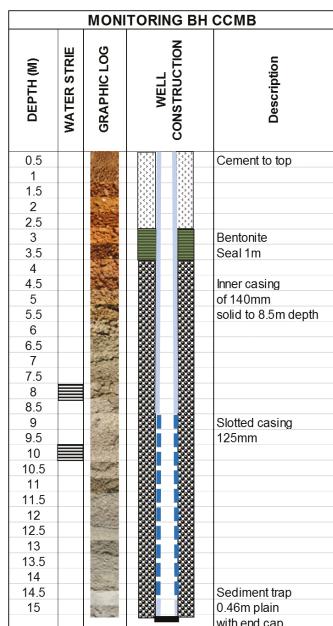


Figure 5 Graphic borehole log and well construction of monitoring borehole CCMB at the CIMMYT conservation agriculture plot at Domboshava Training Centre in Zimbabwe. The log shows a typical weathering profile with reddish brown topsoil with chips of quartz and feldspar (0–5 m), transitioning into a more clay rich, micaceous saprolite layer (5–7 m), and gradually into granitic fresh rock from 7 m on. The rest water level one day after drilling was observed at 7 m below ground level.

was successfully completed in the conventional plot. By running the pumping borehole and monitoring water levels in the observation boreholes the CEPHaS hydrogeologists can learn about the behaviour of the site. By installing geophysical electrodes in the pumping borehole (see CEPHaS Briefing Document 3) the team can visualize the behaviour of the water table during these pumping tests. Additional monitoring boreholes were installed adjacent to other sites used by CEPHaS at DTC, and in a nearby wooded area (for comparison in a different land use setting). At the Liempe site near Lusaka, Zambia, four monitoring boreholes in the upper, perched aquifer, and one pumping borehole could be successfully completed.

ONGOING ACTIVITIES

Data from the installed high-resolution groundwater level loggers will be read out at monthly intervals, and manual dip measurements will be taken at each time to check that the equipment is working properly.

Drilling at the field site in Malawi is at the planning and scoping stage, with drilling activities scheduled for late spring 2019 (after harvest). Pump tests and water sampling campaigns in each country are ongoing. There will be a large on-the-job training element in the aquifer testing, focussing both on proper conduct of the tests and also on analysis procedures.

In addition to this on-the-job training, formal training for CEPHaS staff is planned during the CEPHaS Harare workshop in July 2019, and a specialist Hydro Training workshop is planned to take place in the UK before November 2019.

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).



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.

UK Research and Innovation



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