

## ***Interactive comment on “Shallow groundwater in sub-Saharan Africa: neglected opportunity for sustainable intensification of small-scale agriculture?” by J. Gowing et al.***

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Having worked throughout Africa, Middle East and Latin America for 30 years, it was my impression that the use of shallow groundwater for irrigation was taken for granted as I have seen it everywhere accessed and used for this purpose. And, electrical resistivity is probably not the best method for location of hand dug wells or boreholes. It does not measure any property of the water but rather the resistivity of the aquifer rock material which has been correlated with groundwater occurrence. The only geophysical groundwater exploration method is Thermo-nics ([www.agwconsultants.com](http://www.agwconsultants.com)) that has been used in Ecuador, Pakistan, and throughout the United States. On a project for the Government of Burkina Faso some years ago, I was retained to teach Burkinabe

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Hydrogeologists how to use fracture trace analysis. Fracture trace analysis is sometimes called lineament analysis. As the authors indicate 40% of Africa is underlain by crystalline rock where water occurs commonly in fractures within the rock. After training was completed we selected several villages to demonstrate the method in the field. Lineament analysis makes use of aerial photographs and the trick is to find on the ground the location found on the aerial photograph. This method was developed in the 1960's by two of my professors at Penn State, Dick Parizak and Larry Lattman. Dick was the hydrogeologist and Larry was the photo-interpreter. At the first village we went to (whose name escapes me at the moment) after meeting with the village leaders we set about locating a well site. Having done that, and as we were leaving the village, a small boy came running up to us and with great excitement he took us to a site picked by GOBF hydrogeologists a week earlier where used electrical resistivity. It was only feet away from our chosen site. Difference was, it took me 10 minutes to locate the same site. Lineament analysis has been used extensively by Swedish AID hydrogeologists in Nigeria and elsewhere and there are many publications in the literature. I have seen hand dug wells used for irrigation in Kenya, ex-Zaire, Tunisia, Mali, Mauritania, Sierra Leone, Somalia, Burkina Faso, and elsewhere. In Mauritania the hand dug wells are generally constructed with the help of primacord and explosives. They are commonly constructed in alluvium of wadis where the shallow wadi aquifers are recharged from rainfall and flood events. I think each area has pretty much defined the type of ground water occurrence and they have worked out the best extraction methods. A hundred years ago, hand dug wells were constructed in Cyprus. In the Ayia Marina coastal plain of Cyprus. I myself monitored water levels in more than 100 of these small scale shallow wells They chose to use small diesel engines manufactured by Lister and Skoda and others. The most common was the 5 HP Lister with a small flywheel and a long flat canvas belt that powered a centrifugal pump connected to a centrifugal pump situated close to the water table. Small farmers in the area had organized a cooperative and all of their diesel fuel and other supplies were bought through their cooperative. Further, the cooperative marketed their products both into

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the local wholesale markets and internationally. R A Lister & Company was founded in Dursley, Gloucestershire, England, in 1867 by Sir Robert Ashton Lister (1845–1929), to produce agricultural machinery. A Google search will provide a wealth of information on he famous Lister cold-start diesel engines.

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