**Project overview**

*Project name*: Resilience of intensive groundwater abstraction from weathered crystalline rock aquifer systems to climate change in sub-Saharan Africa

*Project aim and brief synopsis*:

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| The aim of this case study was to investigate the resilience of intensive groundwater abstractions from weathered crystalline rock aquifer systems to climate change. The sustainability of such abstractions was investigated by examining historical aquifer responses to climate and intensive (> 1 l/s) abstraction, and investigating groundwater residence times at sites of intensive groundwater abstraction using multiple tracers: chlorofluorocarbons (CFCs), sulphur hexafluoride (SF6) and tritium (3H/3He).  DFID funded. BGS, UCL and ODI |

*Country* : Tanzania and Uganda *Main Region(s)/ Town(s):* Tanzania – Makutapora, Singida; Uganda –Mubende, Rukungiri, Seeta.

*Project leader*:

*Project staff and main responsibility (including project partner details)*:

BGS - Louise Maurice, Alan MacDonald, George Darling, Daren Gooddy

UCL – Richard Taylor

Uganda:

* Dr Callist Tindimugaya, Ministry of Water and Environment, Uganda
* Dr Michael Owor, Department of Geology, Makerere Unviersity, Uganda
* Mr Rashid Kisomose, Ministry of Water and Environment, Uganda

Tanzania:

* Mr Lister Kongola, Ministry of Water and Irrigation, Tanzania
* Mr Alloice Kaponda, Ministry of Water and Irrigation, Tanzania
* Mr Renatus Shinhu, Ministry of Water and Irrigation, Tanzania
* Dr Ibrahimu Mjemah, Sokoine Unviersity of Agriculture, Tanzania

*Length of project*: *From*: 2009 *To*: 2010

*Caveats on data use*:

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| Data produced by BGS has unrestricted use. |

**Data collected**

**Chemistry data**

*Groundwater chemistry:* yes

*Estimated number of sites*: Tanzania 15 sites– field chemistry, IC, ICP MS, NPOC, CFC, SF6, δ18O, δ 2H δ 13C, tritium. Uganda 7 sites – field chemistry, IC, ICP MS, NPOC, CFC, SF6, δ18O, δ 2H δ 13C, tritium *Time series data: ~~yes~~/no*

*Surface water chemistry: ~~yes/~~no* *Estimated number of sites*: *Time series data: yes/no*

*Precipitation chemistry: ~~yes~~/no* *Estimated number of sites*: *Time series data: yes/no*

*Other: eg waste waters, irrigation waters, soil samples*

*Please record here if the data was collected by BGS and/ or partners and who the partners were along with any restrictions for the use of the data*

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| Data produced by BGS has unrestricted use. |

**Hydrogeological data**

*Boreholes drilled: no* *Approximate number*: *Approximate depths*:

*Waterlevel data:* yes. Historical time series data (Tanzania – 12 boreholes, Uganda – 4 boreholes).

*Rainfall data*: Yes *Manual / automatic*: *Time series data:* yes, see Taylor et al 2013.

*Aquifer properties data*: Historical and new data collected by project partners. Tanzania – pumping test and yield data for 12 boreholes. Uganda – pumping test and yield data for 8 boreholes.

*Please record here if the data was collected by BGS and or partners and who the partners were along with any restrictions for the use of the data*

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| Data produced by BGS has unrestricted use. All water level and pumping test data was collected by project partners and is presented in Taylor et al 2013 and Maurice et al 2019. |

**Geological data**

*Additional mapping done during the project: ~~yes/~~no*

*Borehole geology:* historical records presented in papers (Tanzania 6 boreholes; Uganda 7 boreholes)

*Classification of geological materials*: *~~yes/~~no*

*Please record here if the data was collected by BGS and or partners and who the partners were along with any restrictions for the use of the data*:

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**Data output**

*Peer reviewed papers:*

* Maurice, L., Taylor, R.G., Tindimugaya, C., MacDonald, A.M., Johnson, P., Kaponda, A., Owar, M., Sanga., H., Bonsor, H.C,. Darling, W.G., Gooddy, D. (2019) Characterisation of high-intensity groundwater abstraction from weathered crystalline bedrock aquifers in East Africa. Hydrogeol J 27: 459. <https://doi.org/10.1007/s10040-018-1836-9>
* Taylor, Richard G.; Todd, Martin C.; Kongola, Lister; Maurice, Louise; Nahozya, Emmanuel; Sanga, Hosea; MacDonald, Alan M.. 2013 Evidence of the dependence of groundwater resources on extreme rainfall in East Africa. Nature Climate Change, 3. 374-378. <https://doi.org/10.1038/nclimate1731>

*Reports:*

* Maurice, L., Taylor, R., Macdonald, A., Sanga, H., Johnson, P., Darling W., and Gooddy, D. 2010. Case study note: Resilience of intensive groundwater abstraction from weathered crystalline rock aquifer systems to climate change in sub-Saharan Africa. British Geological Survey Internal Report IR/10/105 <https://assets.publishing.service.gov.uk/media/57a08afae5274a27b200089f/60826_IR-10-105_HighyieldingSupplies.pdf>
* Internal project report. Taylor, R., Sanga, H., Mjemah, I. (2010) Resilience of intensive groundwater abstraction from weathered crystalline rock aquifer systems to climate change in sub-Saharan Africa. Field Report – Tanzania Workpackage 2 Climate Change and Groundwater Project DFID Contract No. GA/09F/094
* Parent project MacDonald, A.M.; Bonsor, H.C.; Calow, R.C.; Taylor, R.G.; Lapworth, D.J.; Maurice, L.; Tucker, J.; O Dochartaigh, B.E.. 2011 Groundwater resilience to climate change in Africa. British Geological Survey, 32pp. (OR/11/031) (Unpublished) <http://nora.nerc.ac.uk/id/eprint/15772/>

*Parent project webpage address:* <https://www.bgs.ac.uk/GWResilience/>

*Project Webpage:* [*https://www.bgs.ac.uk/research/groundwater/international/africangroundwater/caseStudy2.html*](https://www.bgs.ac.uk/research/groundwater/international/africangroundwater/caseStudy2.html)