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**LOCAL ACTION WITH INTERNATIONAL COOPERATION TO IMPROVE AND
SUSTAIN WATER, SANITATION AND HYGIENE SERVICES**

**Individual water sourcing: understanding risks and
resilience to groundwater resource abstraction in Nigeria**

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Across much of Africa, domestic water supplies are increasingly dependent on groundwater reserves. As the cost of accessing these reserves fall, expertise becomes more widely available and incomes rise there is a rising trend towards the private commissioning of boreholes and wells. This nascent shift towards a distributed and increasingly individualised water supply may have many implications for the resilience of communities to future environmental shocks, which are, as yet, under-explored. Drawing on the case of Nigeria and new interdisciplinary research, this paper addresses this gap, through a specific focus on understanding the behaviour and choices of individuals and other key stakeholders which underpin this trend. It also seeks to understand the possible implications of this for the resilience of associated social and ecological systems.

Introduction

Globally, it is estimated that some 663m people lack access to safe drinking water, of whom almost half live in Africa (UNICEF/WHO, 2015). This impacts on health and well-being, as well as limiting the ability for people to move out of poverty (Grey and Sadoff, 2007; Hunter et al., 2010). Tackling this challenge, by improving access to safe and reliable water supplies, has been one of the central goals of the global agenda for sustainable development (United Nations, 2015). Whilst the original Millennium Development Goal of securing access to improved water sources has now been met, water use is set to increase markedly over the coming decades as a consequence of population growth, anticipated increases in irrigation and rising demands as lifestyles and expectations change with increasing incomes and changing societal expectations. This raises new questions as to the resilience of the water supplies on which so many depend, particularly in the face of sudden or slow-onset environmental hazards.

The World Economic Forum has gone so far as to identify a water crisis as one of the most likely events to occur in the next ten years and, significantly, the one that will have the largest potential impact on society (World Economic Forum, 2016). This not only emphasizes the significance of the issue, but also encourages consideration of the economic and social resilience of the communities that rely on sources of water that are vulnerable to both environmental and other hazards. Whilst some hazards are natural others are anthropogenic, with the possibility that current water development trends may be setting in train paths that prove to be less sustainable in the longer-term.

One trend in water supplies has gone largely unremarked to date. That is the increasing prevalence of privately-commissioned boreholes and wells, tapping into groundwater reserves, which lie outside of the public water-supply. This nascent shift towards a distributed and increasingly individualised water supply may have many implications for the resilience of communities to future environmental shocks, which are, as yet, under-explored. Drawing on the case of Nigeria and new interdisciplinary research, this paper addresses this gap, through a specific focus on understanding the behaviour and choices of individuals and other key stakeholders which underpin this trend. It also seeks to understand the possible implications of this for the resilience of associated social and ecological systems.

The paper draws on fieldwork currently being undertaken in three locations in Nigeria (Lagos, Lafia and Maiduguri). The results of this fieldwork will be available for the conference presentation itself.

The rising individualisation of water supply systems

The vital role that groundwater reserves can play as part of resilient water supplies is increasingly recognised across the developing world (Howard et al. 2016, MacDonald, 2011). It also forms the primary source of available water for many communities. Indeed, it is estimated that across Africa groundwater meets around 75% of domestic water demands (reported in UNICEF/Skat Foundation, 2016). This has, in part, been enabled through a significant increase in water wells, or boreholes, financed by governmental development programmes and NGOs as well as investments by water users and local businesses (UNICEF/Skat Foundation, 2016).

The development of groundwater resources has been driven partly by its ease of access relative to surface waters, and by lower levels of contamination, reducing the need for water treatment (Calow and MacDonald, 2009). As the costs of exploiting groundwater resources fall and the knowledge and expertise to access this become more widely available, so does the provision of groundwater supplies. This is particularly so where hydrogeological conditions are suited to the easy exploitation of groundwater reserves. The lack of a reliable (and trusted) public water supply system also drives many communities and households to source their own supplies through tapping into groundwater resources, often facilitated by the active support of NGOs and developmental bodies.

This is exemplified in Nigeria where there has been a rapid expansion in the numbers and scale of privately-developed wells and boreholes over the past two decades and a rising reliance on groundwater supplies (WHO/UNICEF, 2016; IAH, 2015). Whilst the population using tapwater and surface water has fallen since 1999 (Figure 1), the numbers using boreholes and hand-dug wells for drinking water have increased significantly (+441% and +29% respectively). Qualitative evidence reinforces this tendency for individual households to increasingly source their domestic water supplies through their own borehole, or one shared with a few neighbours. Households either commission their own borehole, make use of one commissioned by community institutions, such as health centres or churches (Onyenechere and Osuji, 2012), or are provided with access as part of a private housing development.

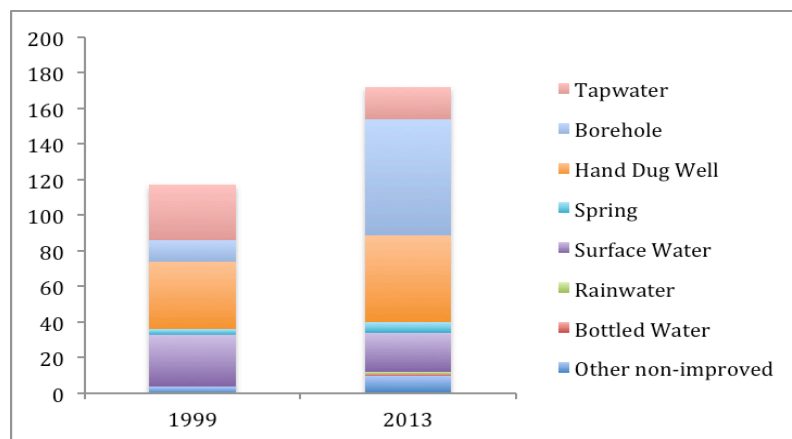


Figure 1. Drinking water source in Nigeria ('000,000 persons)

Source: UNICEF/WHO (2015)

The trend towards the individual abstraction of groundwater supplies is not only evident in the activities of households. Major urban extensions, such as Eko Atlantic in Lagos, will provide piped water to some 450,000 residents and an international business district from its own treatment plants and distribution mains, with the water itself sourced from 'deep wells' (Marcopolis, 2016).

The proliferation of privately-commissioned boreholes is leading to new governance challenges. This relates both to the siting of boreholes (by skilled and unskilled technicians), with varying degrees of success

(reported in Jideonwo, 2014) and to the unplanned and uncontrolled exploitation of groundwater, with the Lagos State Governor, Babatunde Raji Fashola, noting that privately-commissioned boreholes constitute a long-term environmental impact and cause damage to the state and ‘our people’ (reported in Omoniyi, 2012).

Resilience and groundwater resources

Consideration of the resilience of groundwater supplies has traditionally taken an ecological perspective, emphasising the security of the quantity or quality of the supply. In this respect, the evidence suggests that existing reserves of groundwater are sufficient to meet most anticipated environmental shocks (MacDonald et al., 2011). Indeed, MacDonald et al. argue that groundwater reserves may prove to be more resilient to anticipated climate change owing to their greater ability to store and conserve water over time.

An emerging risk is that contaminants enter the groundwater resource, making it unfit for consumption, as reported in Asia, where more than half the groundwater reserves are now described to be too contaminated to use (MacDonald et al., 2016). In Nigeria, there is no evidence that this is yet the case. In a recent study for the World Bank, Kumpel et al. (2014), found that in Port Harcourt, a major coastal city, levels of contamination of water sourced from groundwater was low. There was some evidence of faecal contamination, primarily in hand dug wells and some boreholes, but overall levels were not reported to be a cause for concern.

However, the lack of regulation and governance of the practice of privately-commissioned boreholes is argued to present risks both to the quality and the quantity of the future groundwater supply (IAH, 2015). Developing effective groundwater management approaches is challenging, not least given the range of different agents involved, their competing interests and demands, and variations in the hydrogeological environment (IAH, 2015). Choices being made now in the siting of wells, the quality and form of their construction and the levels of abstraction, have long-term impacts on the quality of the groundwater resource (locally and more widely), the quantity available for abstraction, the accessibility of supplies to different societal groups and the vulnerability of the resource to future shocks. Yet the nature and drivers of these choices are poorly understood (Kumpel et al., 2014).

Insights from resilience studies in social science emphasise how the resilience of ecological systems are critically linked to the adaptive capacity of social systems and their agents (Bristow and Healy, 2014a). This highlights the importance of human dimensions and processes in adaptive management policies and processes, notably shared interpretations of risks, the importance of understanding desirable adaptive behaviours, and potential temporal trade-offs alongside balancing individual vs collective interests (Bristow and Healy 2014a).

Deepening our understanding of the factors that influence the choices of different actors is perhaps the greatest challenge facing those seeking to ensure the development of water supply systems that provide communities and their environments with the capacity to be resilient to future environmental challenges. To do so, involves not only understanding economic and technical attributes but also the social conditioning of risk perceptions, including the role of different media in constructing communicative narratives (Allan, 2002, 2013), These dynamics influence future expectations by cultivating collaboration over individualism in the face of moral hazard and social dilemmas within lived communities (Capstick, 2013; Howell et al., 2016).

Extending the debate

The trend towards a distributed and increasingly individualised water supply system, raises new questions for the resilience of the households and communities that depend on particular sources, as well as the associated social and environmental systems. Rising levels of water abstraction, much of which may be unplanned and unregulated, raises new challenges for water management in the future.

In the context of rising demand for domestic water supplies, rising incomes and potential future environmental shocks, it is necessary to develop a greater understanding of the drivers of decision-making amongst various stakeholder groups. This can inform our understanding of the choices being made by different parties and so assist in developing effective governance and management approaches of a critical ecological resource, one on which the livelihoods of many millions of persons now depend.

The purpose of this study is to develop and test an innovative framework for understanding the interplay between environmental resources, social systems and behavioural choices affecting the resilience of communities to rising abstraction of groundwater supplies. It will do this through developing a mixed-

methods approach that will be trialled in three pilot study areas in Nigeria. This will enable the study team to consider the role groundwater resources can play in building the resilience of communities to future potential environmental shocks; the risks posed by private abstraction trends to the resilience of communities to sudden or slow-onset environmental hazards; the role of different media in framing communities' understanding of groundwater resources, and individuals' and organisations' perceptions, choices and behaviour; and how perceptions, choice, behaviour and agency can influence (policy) actions to reduce vulnerabilities and enhance resilience.

The results to be reported will cast a light on the decisions currently being taken in Nigeria, and help to illustrate the complex web of influences that shape these. The research will begin to address the need to better understand the drivers of water source choices in countries with rising incomes and will assist in shaping policy conclusions that encourage the building of communities that are resilient to future environmental shocks.

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References

- ALLAN, S. (2002) *Media, Risk and Science*. Maidenhead and New York: Open University Press;
- ALLAN, S. (2013) *Citizen Witnessing: Revisioning Journalism in Times of Crisis*. Cambridge: Polity Press;
- BRISTOW, G. and HEALY, A. (2014a) 'Regional Resilience: An Agency Perspective', *Regional Studies*, 48 (5), pp. 923 – 935;
- CAPSTICK, S. B. (2013) Public understanding of climate change as a social dilemma. *Sustainability*, 5(8), 3484-3501;
- GREY, D. and SADOFF, C. W. (2007) Sink or Swim? Water Security for Growth and Development *Water Policy* 9 pp.545-571
- HOWARD G, CALOW RC, MACDONALD AM and BARTRAM J. 2016. Climate Change and Water and Sanitation: Likely Impacts and Emerging Trends for Action. *Annual Review of Environment and Resources*;
- HOWELL, R., CAPSTICK, S. B. and WHITMARSH, L. E. (2016) Impacts of adaptation and responsibility framings on attitudes towards climate change mitigation. *Climatic Change*, 136(3), 445-461;
- HUNTER, P. R.; MACDONALD, A. M. and CARTER, R. C. (2010) Water Supply and Health *PLoS Med* 7 e1000361
- INTERNATIONAL ASSOCIATION OF HYDROGEOLOGISTS (2015) *Resilient Cities and Groundwater Strategic Overview Series*;
- JIDEONWO, J. A. (2014) Ensuring Sustainable Water Supply in Lagos, Nigeria. Dissertation Publication. *University of Pennsylvania Scholarly Commons Penn Libraries*. University of Pennsylvania
- KUMPEL, E., ALBERT, J., and KHUSH, R. (2014) *Water Quality Testing Study, Port Harcourt, Nigeria*. World Bank Contract#7167983 , Aquaya , Aquaya , Larkspur Landing, USA
- MACDONALD AM, BONSOR HC, AHMED KM et al. 2016. Groundwater quality and depletion in the Indo-Gangetic Basin mapped from in situ observations. *Nature GeoScience*;
- 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;
- MARCOPOLIS (2016) *Leading Real Estate Development in Nigeria: Eko Atlantic*. Interview with David Frame CEO Eko Atlantic Available at <http://www.marcopolis.net/leading-real-estate-development-in-nigeria-eko-atlantic.htm> Accessed on 17 January 217
- OMONIYI, T (2012) Nigeria: Controversy over proposed ban on boreholes. *Daily Trust (Abuja)*. 7 June 2012. Article accessed from internet January 17th 2017.
- ONYENECHERE, E. C. and OSUJI, S. C. (2012) Water Service Provision in Owerri City, Nigeria. *Journal of Water Resource and Protection* 4 pp.497-506 DOI: 10.4236/jwarp.2012.47058

UNICEF/Skat Foundation (2016) *Professional Water Well Drilling: A UNICEF Guidance Note, Cost Effective Boreholes Partnership of the Rural Water Supply Network*. UNICEF and Skat Foundation, UNICEF/WHO (2015) *Progress on sanitation and drinking water – 2015 update and MDG assessment*. United Nations. New York ISBN 978 92 4 150914 5
WHO/UNICEF (2016) – *Joint Monitoring Programme for Water Supply and Sanitation: Nigeria*. Available at: <http://www.wssinfo.org>
WORLD ECONOMIC FORUM (2015) *Global Risks Report*. World Economic Forum.

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