voice box

Groundwater

Hydrogeology, the study of groundwater, is a young science. Despite its youth, hydrogeologists are expected to answer a wide range of very practical but complex questions. Nowhere is the demand more crictical than in the provision of potable water in low-income countries. Groundwater is often potable at source, commonly free of the microbiological pathogens that plague surface waters. It is also widely distributed, thereby allowing the source to be sited close to the demand. In humid and some semi-arid climates, groundwater is also regularly replenished by rainfall that penetrates through the soil zone. Beyond these basic insights, however, we possess very limited knowledge of groundwater resources in most low-income countries and, relative to the magnitude of current development, there is an astounding lack of active research. As a result, fundamental questions about using this resource are not usually met with quick answers but, typically, more questions.

> *User: 'Is the current rate of pumping from my boreholes sustainable?'*
>
> *Hydrogeologist: 'Well, that depends. The sustainability of a pumping regime relies upon a range of factors including: (1) what reduction in local steamflow or wetland coverage you are prepared to accept; (2) the current pumping rate; and (3) the amount of rainfall that penetrates the soil zone, known as recharge. Do you possess records of pumping rates and water levels in the borehole? Might we conduct a simple study?'*

Engineers and health practitioners often accuse hydrogeologists of being inconsistent or ambiguous in their descriptions on the subsurface. It is certainly possible that for a particular groundwater problem, three hydrogeologists may proffer three different solutions. The profession undoubtedly benefits and suffers, to an extent, from the fact that it is an 'unseen' resource. By comparison, if someone suffers from a hidden and poorly studied ailment, and three physicians offer three different diagnoses, we do not begrudge medicine itself. Indeed, despite the complexity of the subsurface, hydrogeologists are regularly encouraged to simplify this environment for the purposes of facilitating or streamlining its use for water supply and sanitation. This does nobody service. In areas of weathered crystalline rock found throughout much of the tropics, we do not know, for instance, what quantitative impact groundwater abstraction has upon adjacent water sources or how susceptible groundwater-fed water sources are to local contamination. Such deficiencies in our knowledge base are not great mysteries. They exist because we are not committed to improving our understanding of the subsurface.

Whether one is the developer, the donor or the manager (often ultimately government), we, who wish to use the subsurface either as a source of water or as a receptacle for our waste, share an obligation to improve our limited understanding of this valuable, renewable resource. To donors paying for groundwater development or sanitation programmes, invest in a better understanding of what you wish to have used. If you don't, who will? Is it ethical to finance the development of a resource about which we possess only vague understanding? To engineers developing the subsurface, recognise that it is a naturally heterogeneus system that does not lend itself well to 'representative numbers'. Invest in your local hydrogeologist to help explain and deal with this uncertainty. To hydrogeologists, be explicit about what is known and what isn't. Address uncertainty. Failure of each of us to fulfill these duties will not result in some dramatic and catastrophic reduction in access to water or sanitation. Each of us will, however, continue to participate in less efficient development schemes that are prone to 'mysterious' but preventable hazards.

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contributions

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