CITIZEN SCIENCE

Building confidence, hope and dignity in communities through citizen science

Up to her elbows in Limpopo groundwater, an anthropologist ponders pluralism, 'a secular form of enchantment', proselytises for public engagement and spins a yarn on citizen science. She spoke to Matthew Hattingh about her work and a new report published by the Water Research Commission (WRC).

"Quit mystifying science, rendering it accessible only to academics." That's the message from anthropologist Prof Jacqueline Goldin to water researchers and practitioners who need to change the way they work with and talk to communities. "If you are going to make a better world, where people are managing their planet in a wiser and better way, you have to use different tools," said Goldin.

The process of research must be "shared with people who are going to make a difference… ordinary people who are going to look after rivers and groundwater. They want to be part of the solution."

Goldin, who was speaking to the ***Water Wheel*** after the January 2022 publication of her WRC-funded report, ***Polycentricity, pluralism and citizen science: A nexus approach to water resources management*** (**WRC report no. 3042/1/22**), advocates "slow science".

Researchers, especially in the social sciences, should take time finding out who to talk to and about what. They must engage with society and build trust. She pointed out that you wouldn't barge into a government minister's office without an appointment; It might take months to set up a meeting. Researchers must develop a similar patience and respect when

dealing with other sources of authority and structures on the ground, such as traditional leaders, who can be hard to access. Goldin called for "much more thinking than helicopter-ing into communities". Helicopter science is a pejorative applied to researchers from wealthier countries or regions who fly in and out of developing countries and, in a great hurry to publish, eschew meaningful engagement and collaboration with locals.

"It does not work that way where you are trying to build trust with communities," said Goldin, "let us take our time to do it properly… go in there and do thoughtful stakeholder engagement."

She doesn't really blame researchers who remain aloof from communities or pay lip service to engagement. "They don't know how to talk to people. You don't learn about public engagement in academia; you learn about your precious discipline."

Goldin was speaking by phone from Utrecht University, where she has an association with its International Development Studies section. She spends about half the year in the Netherlands and the balance back home at the University of the Western Cape, where she is an Extra-ordinary Associate Professor in the Centre for UNESCO Chair for Groundwater in the Faculty of Natural Science.

Her recent research work is in the Hout River catchment area, north-west of Polokwane, the Limpopo capital. It's here, from 2019 to 2022, that she ran a citizen science groundwater monitoring project. Twenty-five monitors were taught to measure groundwater levels and rainfall using drip meters and rain gauges and to upload the data to a shared platform by smartphone. The work was something of a first and Goldin said it provided lessons that would be useful to projects in other catchment areas and to citizen science projects unrelated to water.

She traced her "passion" for water research to the 1990s when she worked on the Working for Water, alien invasive removal project, with Guy Preston, the highly-regarded conservationist, academic and later senior government official. A "numerate anthropologist", who serves on an interim committee to foster South African citizen science, Goldin said her interest in encouraging public participation in research stemmed from her 2005 doctoral thesis. It focused on trust and shame and how "technical talk" by academics, engineers and the government made ordinary people "feel ashamed".

She was at pains to point out that the people in question, with their unique insights and local knowledge, were anything but "ordinary". They also offered a hard-to-beat way of tapping "huge amounts of information" in poor and remote places (like the 2 480 km^2 Hout catchment) that exceed the reach of researchers and the government.

Beyond the data it produced, the project was "all about the transformative process" for the citizen scientist-monitors. "They are getting confidence, dignity and hope," she said. Goldin has secured additional funding from the National Research Foundation to continue her work in the Hout. She will now be teaming up with schools, and the plan is to get 210 citizen scientists to measure river water quality.

It will be a continuation of the work already done on her 'Diamonds on the soles of their feet' project. The name echoes the famous Paul Simon song while reflecting the great store Goldin sets by citizen science and what it's achieved in Limpopo. Here water sparkles or lies buried at the feet of citizen scientists, who are themselves "diamonds", holding as they do "much richness and value to environmental preservation".

Why the focus on groundwater in the initial project?
Goldin and her co-authors, Innocent Muchingami, Thokozani Kanyerere and Tapiwa Hlatywayo (who Goldin credits with the project's technical, water know-how) note that groundwater is limited. Drawn by boreholes out of aquifers, from between soil particles and fractures of gravel, sand and rocks, groundwater has been heavily used, especially for irrigation. It has been polluted by farming, mining and industry. And demand from all sectors is only likely to increase as surface water resources are stretched further.

For these and other reasons, the authors believe everyone using water should be monitoring it – more so the invisible rivers under the ground.

Why the Hout? The area is semi-arid, with an average yearly rainfall of only 407 mm, so groundwater is vital to the people who call it home. These are a complex mix of often poor black people and relatively rich white commercial farmers – who rely on centre pivot irrigation to water their crops, notably potatoes. All this makes for fertile ground for study and intervention.

The report seeks to analyse and understand the project in theoretical terms. It begins by looking at the geography of the area and its context as well as surveying the big players. By this the authors mean the institutions, agencies, government departments and others with links to water monitoring as well as the municipal authorities and tribal chiefs who hold sway over large parts of the Hout (and more than 40% of South Africans).

An overview of the laws and regulations around monitoring groundwater shows just how many layers there are and the complexities of working with people governed by many different rules, some very formal, others less so. The next part, which lends the report its title and its meat – deals with what the authors regard as complementary concepts: nexus, citizen science, pluralism and polycentricity. It considers what these concepts mean and how they might help us fashion a conceptual framework to better understand groundwater monitoring and citizen science.

Nexus is about how natural resources – land, water and energy – are interlinked and need to be managed together for the common good. The authors bring in this nexus to warn against seeking simple quick-fixes and when trying to understand a landscape – its geography, its politics and its people.

Citizen science, increasingly in recent decades, has involved thousands of lay volunteers 'collecting, commenting, transcribing

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Citizen scientists using a dip meter to measure water levels of boreholes in Limpopo's Hout catchment area.

and analysing data', usually working with professional scientists. Mostly this has been in the natural sciences and concerned with the study of physical and natural phenomena. It has proved especially useful in studying large-scale patterns in nature (bird migration for example) which required the collection of lots of data across various places and habitats and over, sometimes, many years.

A modest 11% of citizen science concerns the social sciences and humanities. But this was changing, with technology helping make communication and the sharing and management of data easier. And the authors have high hopes for citizen science in their field. "The educational aspect underpins the volunteer experience and in the case of our project, literacy about groundwater is empowering and although encouraging citizen participation in data collection and analysis, we see it is primarily a means of meaningful education with huge emancipatory and transformative potential."

For Goldin, citizen science is about taking science out of the library, out of the laboratory and into real life. The authors view pluralism as a "process, not a product", "an interaction between conflicting and competing positions", about recognising diversity and coexistence. This chimes with the feminist thinking they cite, with its notion of an "ethics of care" and focus on justice and the need to acknowledge diversity.

It is not just about managing water – it's about getting to a more just and transformed society, said Goldin. The authors suggest we draw from many perspectives. Whether a farmer, an engineer, a government official, or a local chief is right or wrong in doing something depended on an understanding or agreement with his or her culture and not on basic moral demands that apply to everyone. In this view, "pluralism is an infusion of value in our lives – an interminable quest for ethical orientation. It is a secular form of enchantment".

The report holds that decentralisation and a few simple tendencies or rules provide the conditions for harmonised local behaviour, rather than centralisation and many complex rules. "People are powerful because they control various resources" and "powerful when their power is recognised".
Goldin said she steers away from the overused idea of "empowering people at the grassroots". Rather, she believes people are "full of power", but often trampled on and ignored. "What matters is to provide spaces where their power is heard."

Polycentrism concerns itself with systems that do without central control and instead have "multiple governance units at multiple scales". How do polycentrism and plurality apply to groundwater monitoring? The authors observe that "work on citizen science has not yet provided a theoretical frame that is explicit about equity, social justice and the human right to know". They hope their work with these concepts will help remedy this.

Next, the report offers a meditation on "meshwork". "Meshwork explains more the entanglement of individuals – full of loose ends and always on the move. In a world of life – knotting is the fundamental principle of coherence. It is the way forms are held together and kept in place within what would otherwise be formless."

Spinning their textile metaphor out further, the authors explain how rather than rigid social structures, it's the contrary forces of tension and friction, pulling tight, that give the fabric of society its form and strength. "Meshwork-thinking may provide an appropriate framework… for exploring the social relations within the diverse context of the catchment." Also touched on is the notion of yarning – "from the verb 'to yarn', which means to tell a story – but also to twist fibre to give it strength and durability".

Nexus, citizen science, pluralism and polycentricity. None is a new concept, or at least not very new. But their application in combination to the study of people and water is recent and believed to be novel. This is the first time, the authors said, that these concepts have been brought together and "woven" into the field of water resources management in general and groundwater in particular.

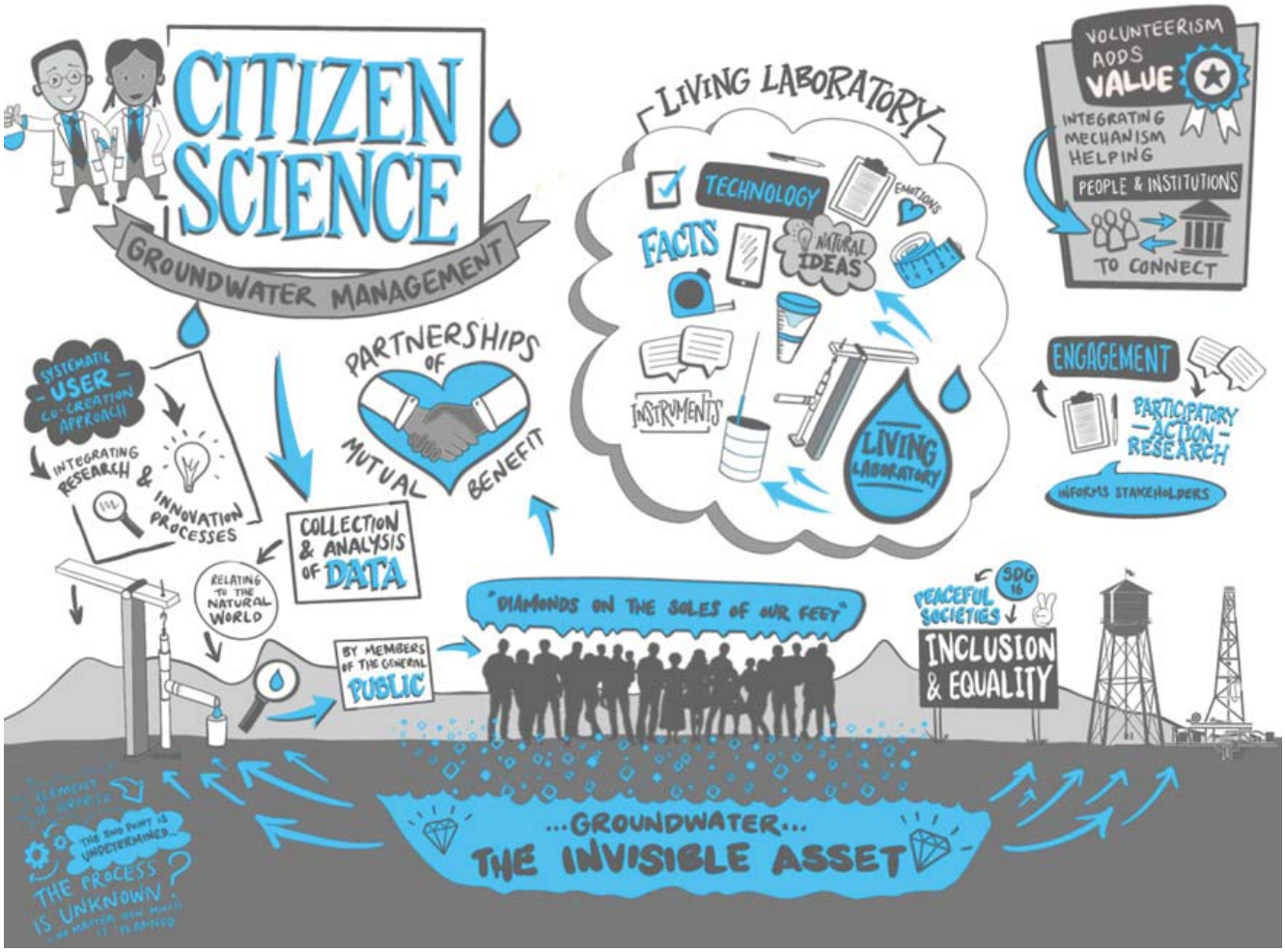
Put simply, they advance the idea that there are many sources of power and authority and they are related to each other and overlap in complicated ways. This is seen as a good thing. Like citizen science, it's democratic, "messy" and "knotty".

The report seeks to show how entangled many of the people, institutions and concepts it discusses are and "how yarning binds disparate ideas and encourages a package that is… forever on the move".

To help readers through the tangle of concepts and parties to their monitoring yarn, the report highlights key concepts in blue text. It also uses creative illustrations as well as storyboards, which combine words and graphics to represent how polycentrism, pluralism and citizen science might be brought together to aid water monitoring.

Goldin told ***Water Wheel*** she is a great believer in the power of art to break down barriers and overcome confusion. "With art you can emphasise new ways of learning and communicating science and a more just world. I believe in creativity. People can see things… it helps them dream and be a part of the solution."

To access the report, ***Polycentricity, pluralism and citizen science: A nexus approach to water resources management*** (**WRC report no. 3042/1/22**), Visit: https://wrcwebsite.azurewebsites.net/wp-content/uploads/mdocs/3042.pdf



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Storyboarding is a technique used in the visual arts and has been adapted for research and community development. The authors see it as another manifestation of yarning – as in 'telling a story'.