

BETSIE LE ROUX

Turning problems into possibilities: Putting people at the heart of environmental sustainability

Dr Betsie le Roux's way of scientific enquiry is unusual. Rather than looking for the norm, she looks for the anomaly. The case everyone else writes off as an outlier is, to her, the one worth studying. An ecologist by training, she approaches environmental questions from the standpoint of the people who live inside them.

Article by Petro Kotzé.

"Within ecology, people are always part of the picture; it's always intertwined," notes Le Roux. "If you improve a poor person's quality of life, that's usually also more ecologically sustainable. One can develop solutions that not only improve the quality of life for households living in poverty, but also enhance environmental quality and help resolve ecological problems."

Her fieldwork of late has centred on a case in point: South Africa's Agri-Parks programme, launched in 2015 to revitalise rural economies through integrated farming hubs. The programme targets the country's most deprived rural and peri-urban areas, aiming to uplift emerging farmers, produce food and redress inequality.

One of Le Roux's Water Research Commission (WRC) funded studies of the programme, where she led a small team, produced a finding typical of her work: the Agri-Parks' widely reported failures did not call for more funding, land or training. They called for something more fundamental. Almost every stakeholder's vision for the programme, she found, was misaligned with the farmers' lived reality. "We are setting them up for failure," she told *The Water Wheel*. Rather than propose another novel fix, her recommended a change in how the existing ones were applied.

That habit of asking a different question rather than reaching for a familiar answer runs through the whole of Le Roux's career.

Early life and a way into water

Le Roux grew up in a missionary family, her father and grandfather both missionaries, in a small community outside Polokwane (formerly Pietersburg). She describes her childhood as steeped in environmental consciousness, the creation, the Earth, how one lives within it, and what one does about the problems one sees. "From [the time] I was small, I was convinced this is what my life's work would be."

She trained first in general biological sciences and then in plant

ecology, earning an MSc in Botany in 2007 before joining the engineering consultancy BKS (Pty) Ltd as an environmental scientist in 2008. The role exposed her to water quantity and quality management, wetland delineation and wastewater treatment, but it was the water quality work that held her attention.

Other parts of the job did not sit as well. She found environmental impact assessments an ineffective tool for protecting rare or fragile environments, and the remote fieldwork, often conducted with limited security, felt increasingly unsafe as she thought ahead to starting a family. She also felt her achievements were not meaningful enough.

Her hopes for a next step that would take her toward water arrived as an opportunity to pursue a WRC-funded PhD in Agronomy at the University of Pretoria, focused on the water footprints of vegetable crops. By then, the mother of a four-month-old daughter, she remembers the decision feeling frightening. "But it was everything I wanted," she says, and so she pushed through.

She completed her PhD in 2017, developing a simplified framework to estimate the volume of water used for agriculture in a catchment, using crop water footprints and production data. Her PhD now behind her, Le Roux's supervisor suggested they apply for a further WRC project, this one on the government's Agri-parks initiative.

Finding her way into Agri-parks

Le Roux explains that part of the motivation for applying was that the topic was new, so the team could compete on an equal footing with other applicants. They won, and she became project leader for a team of agricultural specialists. It would become one of the more demanding, and more rewarding, chapters of her career.

The brief was to assess the Agri-park's water balance. The prevailing assumption was that these were large, farmer-run agricultural zones that drew heavily on local water, but this was not what they found. It turned out to be five farmers on three hectares, entirely government-run, she says.

The farmers shared a single borehole pump on a rotating schedule, and each ran it almost non-stop on their turn, because once you had access, you used it for as long as you could. "As I got into it, I realised this wasn't just an agricultural problem; it was a deep social problem," notes Le Roux. "So the kind of solution people usually propose, namely 'let's use water more efficiently', is actually pointless."

Le Roux also realised they weren't the right team for this kind of problem, which she describes as socially complex, beyond the grasp of agricultural technological solutions. She turned to her father, Dr Attie van Niekerk, whose own path had taken him from missionary and theology work into development work focused on poverty alleviation. In 1994, he founded the Nova Institute, a non-governmental organisation (NGO) focused on improving quality of life for poor households. With his input, the project produced results strong enough for the WRC to commission a follow-up study.

The real outcome, she believes, was arriving at a better research question altogether: how does water-use efficiency relate to the market, and to the whole ecosystem and web of relationships between government and the farmers that the Agricultural Hub was meant to serve. "There are so many issues bound up in this that you'd really need a much deeper study," she says.

This one identified a pattern among successful smallholder farmers and led to the Sukuma Transformation Tool, which determines the level at which a farmer is operating, assesses how efficiently they work, and identifies what needs to change before they can proceed to the next level. Le Roux now also works part-time for Nova. What drew her to the NGO, she says, is its focus on implementing ideas that more traditional research projects can only formulate.

A father's wisdom, shared

Much of how Le Roux works traces back to something her father told her early on. "The problem doesn't lie with the people," he said. "It lies in the fact that you're coming from a completely different context. The solution you give them might work fine in your own context, but not in theirs."



Dr Betsie le Roux, photographed here with WRC research manager, Dr Samkelisiwe Hlophe-Ginindza, is a self-employed specialist researcher, with over 15 years of experience in agronomy, botany, water management and project management.



A farmer shows off her crops at Lefatlheng, Hammanskraal. Le Roux believes that working with communities towards solutions, rather than imposing solutions on them, is the secret to successful communities.

The world people actually inhabit sits beyond the reach of purely rational thought, explains Le Roux. People can tell you that something works without being able to say why. They are not always consciously aware of everything an outsider would need to understand to design a solution properly. "So the only way to actually develop something workable is to do it together with them," she says.

That means treating the community as part of the team, something she describes as particularly hard because of a delicate power balance. When you are seen as the expert, you are also expected to know the answer, and often you yourself think that you do. The answer, she believes, lies in talking less. "The first step is not to come in with a fixed idea, but rather to ask and to listen, and try to understand." Whenever someone on her team talked too much, she found the power balance snapping straight back to "everything must come from us."

"I think part of why we get it right is that we work across so many different projects that we're never really the specialists in any one of them. We come in fresh each time, ask questions, try to understand the real problem, and by the end of the conversation, [stakeholders] start to understand the problem themselves, or begin looking for solutions on their own." It is an approach, she admits, which is hard to teach.

A toilet nobody wanted

Career highlights for Le Roux are not papers or policy wins, rather it's when a community wins. To illustrate she recalls a project that involved a specific toilet, despised by the community in which it was installed by the municipality. "The women there said that after using the toilet you'd have to go and change your clothes, otherwise you'd carry the smell with you."

Her team spent months working on-site to solve the problem alongside the community. After many discussions, they decided on a simple urine-diversion trap that directs the liquid into a bottle and lets the solids drop into a small basket lined with

grass. The system produces compost and a comfrey-based liquid fertiliser for vegetable beds. "It's now a really good toilet," Dr Le Roux says. "I use it myself whenever I'm there."

The proof is in how people rated it. The first time Le Roux's team asked, a mother scored her household's toilet a one out of ten. Her daughter gave it zero. Asked again roughly two years later, mother and daughter both said ten.

Nearby, a farmer named Sammy has become one of the project's biggest advocates for the use of treated urine as fertiliser. Once needing to commute to town for a job in a shop, Sammy has expanded his farming operations to around 500 square metres to earn roughly what he used to earn in town. His enthusiasm for the 'new' fertiliser is clear. "Yes, welcome, just bring urine!" he told Le Roux's team enthusiastically when they last enquired if they could visit. Their work in the area now includes continued investigation into the effectiveness of different fertilisers and the safety of urine fertiliser should commercial distribution of the crops be considered.

Le Roux also mentions successfully trial-running the idea to discuss problems in working groups selected by the farmers themselves. It created space for all roleplayers to connect and network, leading to long-term working relationships.

Results like these did not come from arriving with a plan. In focus groups, Le Roux's team never opens with an agenda, but rather names the subject, for example, sanitation or agriculture. Then they sit, listen and take notes. Two hours can pass on agricultural problems for every ten minutes spent on sanitation, which tells her which problem the community is actually trying to solve.

Learning to sit with complexity

That toilet is also small proof of a theory Le Roux started reading about around 2019 and 2020. Complex-systems theory gave her a language for something she already sensed in the field – that a social system is complex, and fixing its separate pieces in isolation rarely helps. "Sanitation isn't something you can fix

on its own," she explains. "You have to look at the whole picture. Everything is integrated."

That belief also shapes how her team avoids being directive. Rather than arriving with a single solution, they offer three or four options. Given a choice, people weigh up what will actually work for them, and often talk themselves into a version suited to their own circumstances. "Once communities start getting it right themselves, they're invested, and they begin working with you properly, incorporating their own ideas," Le Roux notes.

It also means paying close attention to whoever succeeds, rather than averaging across those who do not. Sammy is exactly that kind of case. "Whereas conventional science always looks at the average, we're always looking at the outliers, where cases actually worked. A conventional scientist would say if everyone failed, that one success was just an anomaly, but for us, that's exactly the outcome that matters." Her team studies what that farmer did differently, then tries to replicate it with everyone else.

It is a slow method, and she credits the WRC with being willing to fund it. "You're working for three years with just five to ten households, and the numbers are so small that most funders don't see the value in it," she says. "That's the one thing we've appreciated most: that they're genuinely on board with it."

What success looks like

Le Roux intends to keep doing what she is doing, moving between agriculture, sanitation and water management as new ideas arise, adding whatever she can to the work. "Success, for me would be contributing as much as I possibly can toward better outcomes for households. "For me it's about how much I can do for households living in poverty and for the environment."

It is a view shaped by the foundation laid in her early career. Ecology taught her that people are never separate from the environments researchers study. In her experience, if you improve a poor household's quality of life, you usually improve that household's ecological footprint too, especially if you understand that, from the beginning, the poor quality of life of a specific community and the ecological problems they experience are all part of a larger, complex, socio-ecological system.

"The more I can do in that direction, the happier and more successful I'll feel," she says. "If, by the end of my career, I've managed to scale up one or two really good ideas that have had real impact, I'll be happy. That would be success for me."



To read more about Dr Betsie Le Roux's research visit: <https://orcid.org/0000-0002-2079-5539>

The five tiers of the Sukuma Transformation Tool

TIER 1	TIER 2	TIER 3	TIER 4	TIER 5
Survival farmer Small food garden (for own survival)	Early livelihood Sustenance with some sales	Livelihood expansion Increased production and sales	Early commercial Structured production and markets	Emerging commercial Large-scale and professional
Farm size 20 – 100 m ²	Farm size 200 – 400 m ²	Farm size 400 – 600 m ²	Farm size 1 200 – 1 500 m ²	Farm size 5 000 m ² and above
Water use (per day) 100 – 150 litres	Water use (per day) At least 600 litres	Water use (per day) 1 200 litres	Water use (per day) 3 600 litres	Water use (per day) 15 000 litres
Cabbages (per 4 months) 200	Cabbages (per 4 months) 800	Cabbages (per 4 months) 1 600	Cabbages (per month) Around 900	Cabbages (per 4 months) 20 000
Irrigation method Buckets or hosepipe	Irrigation method Buckets or hosepipe	Irrigation method As appropriate	Irrigation method As appropriate	Irrigation method Irrigation systems and scheduling programmes
Labour No employees	Labour Family member(s)	Labour Seasonal workers	Labour Permanent and seasonal workers	Labour Permanent and seasonal workers
Time and resources Minimal time investment No resources (e.g. transport)	Marketing Some sales to neighbours casual marketing	Marketing Local, informal market More time for marketing and sales	Equipment Tractor and plough	Key activities Planning, compliance, labour management and selling
Income No income – crops for own use only	Income Some income from crop sales	Resources Wheelbarrow or similar transport	Transport Contractor used to transport crops to local commercial market	Marketing Formal market
		Income Increasing profits	Time Full-time: half a day in the garden, rest of time on planning, marketing, managing workers and selling	Income Commercial income (large-scale)

The five tiers of the Sukuma Transformation Tool. The tool is an agricultural evaluation framework designed to support the empowerment and commercial scaling of smallholder vegetable farmers. Instead of attempting to immediately push small-scale farmers directly into large-scale commercial farming – a primary reason many agricultural initiatives fail – the tool focuses on gradual, structured growth