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For environmental monitors, relationships matter in multiple ways: insights from a research collaboration in South Africa

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The literature identifies several challenges facing natural resource management collaboration, from structural conditions like corruption to divergent interests, skewed decision-making powers and logistical, communications and information failures. The case study on which we base this paper examines a successful collaboration between university-based scientists and citizen environmental monitors in a rural region of South Africa. The Tsitsa project aimed to create benefits for people and environment, through collaborative research towards sustainable natural resource management. However, collaboration was not a given, and the lessons learnt in this regard form the gist of the paper. Using a relational realist lens, we conduct a secondary analysis of a case study undertaken in 2019–2020, into what the Tsitsa citizen monitors valued. It proved vital that researchers approached monitors in ways that communicated care, respect and trust, such as addressing them in their own language, being available for follow-ups, and paying for their work. When relational aspects were taken care of, collaboration flowed, and it was evident that citizen monitors share with scientists core human values: family, social standing through contribution, friendships and stimulating work, an interest in the environment and pride in a job well done. Our practice-based insights into the causal powers of relationships and the value of careful relationship-building for more sustainable and just natural resource management relationships adds to the emerging body of work on relationality in the sustainability sciences.

KEYWORDS

citizen science, environmental monitors, collaborative research, natural resource management, relationality

Introduction

Situating the study in its socio-political context

The landscapes of Southern Africa are characterized by bountiful wildlife and beautiful vistas, by youthful communities and resourceful people, but also by abject poverty and socio-economic inequality and the rampant degradation of natural resources. Throughout the region there have been a range of policy and practice initiatives to stimulate more equitable and environmentally sustainable development by broadening collaboration in natural resource management (NRM).

In South Africa, the context of this paper, these initiatives include the creation of employment, enterprises and livelihoods in nature-based tourism, land rehabilitation, wetland restoration and environmental monitoring, among others. South Africa's first *Green Jobs* report (Maia et al., 2011) estimated that the biggest employment gains in a transition to a "green" economy would be in the protection, restoration, monitoring and management of water, biodiversity and other natural resources.

One of the challenges in realising the potential of NRM to improve livelihoods in South Africa is overcoming a legacy in which Science has historically been the almost exclusive preserve of educated white South Africans, and caring for the environment often regarded as either nothing more than menial labour, or a "privileged white" concern (Khan, 2000). During colonization and in the apartheid era, Black South Africans have been excluded from owning land and leading NRM decisions. One of many post-apartheid policy initiatives to address this legacy is a Biodiversity Human Capital Development Strategy: 2010–2030 (BHCDS) under the auspices of the South African National Biodiversity Institute (SANBI, 2010). The BHCDS recognizes the need not only for more black scientists and leaders to manage the country's biodiversity today, but also for a *cultural transformation* in the environmental sector, so that it becomes more inclusive of all Black South Africans. While volunteer citizen science initiatives are not yet common among Black South Africans (Mtati, 2020), the mid-term review of the BHCDS (Rosenberg et al., 2021) found a growing number of initiatives where Black youth and communities are actively leading, contributing to and making a living from the sustainable management of natural resources, including environmental monitoring.

The case study on which we base this paper is of a research collaboration involving citizen science (environmental monitoring) between university-based scientists, government officials and rural communities in the Tsitsa region of the Eastern Cape Province of South Africa. This project intended to create benefits for people and environment, through collaborative research, collaborative NRM and collaborative development projects. However, *collaboration was initially not a given*, and it is the lessons learnt in this regard, that form the gist of a story worth telling. As the review of the literature will show, there are a number of challenges facing any NRM collaboration, including but also going beyond structural-historical factors.

Through a re-reading of the data collected and analysed by Mtati (2020), we identify *relational* factors that helped university-based scientists to effectively engage rural citizens as environmental monitors. We argue that *relational* factors—being trustworthy, available, and showing respect in culturally appropriate ways; making an effort to converse in the local language; carefully designing both initial and ongoing training; and sustaining relationships beyond the mere technical requirements - are easily overlooked but ultimately very important. The identified factors resonate with and add to the strategies to address sustainability collaboration challenges identified elsewhere (e.g., Ayala-Orozco et al., 2018) and thus respond to calls for more research on sustainability collaborations from the Global South, while adding empirical depth to the growing work on what West et al. (2020) described as the relational turn in the sustainability sciences.

Situating the study in the literature on collaboration and relationality in NRM

A focus on relationality

Not only in South Africa, but around the world scientists, resource managers and ordinary citizens are recognizing that we need to work *with* each other if we are to achieve socio-economic development that is socially just and environmentally sustainable. Such collaborations involve diverse role players finding ways to work together to address complex sustainability challenges, and co-produce knowledge and action across a range of institutional types, disciplines and socio-cultural groups, using a diversity of methods and approaches, as reviewed and analysed by Chambers et al. (2021), Norström et al. (2020) and in this special issue.

There is an established body of literature on collaboration for sustainable NRM: see, for example, Bodin, (2017); Borrini-Feyerabend et al. (2013); Cockburn et al. (2018a); and Margerum & Robinson, (2016). This area of study intersects with related areas such as collaborative governance (Carr Kelman et al., 2023), collaborative conservation (Wilkins et al., 2021), co-management and adaptive co-management (Armitage et al., 2007); transdisciplinary approaches to research and knowledge production (Biggs et al., 2022); and other frameworks and approaches reaching for more inclusive environmental management and governance.

Two insights emerging from this literature are pertinent to this paper. The first is that there are ethical as well as pragmatic imperatives to involve multiple role players in NRM, in order for it to be sustainable and just (van Koppen and Schreiner, 2014; Wolff et al., 2019). The second is that there are also significant barriers and challenges associated with achieving this aspiration (Margerum and Robinson, 2016; Raschke et al., 2023). Various authors have proposed frameworks and approaches to understand and better enable collaborative initiatives, including a wide range of "design principles" (Ostrom, 1990) or "factors" (Carr Kelman et al., 2023) which are necessary for collaborations to succeed.

However, researchers also acknowledge the pitfalls of generalised theories and frameworks, and the significant challenge of multiple and intersecting dimensions of collaboration among diverse role players, often with divergent or conflicting interests, in complex, dynamic social-ecological systems (Poteete, 2012). Collaborative endeavours are shaped by historical and present-day contexts, and there is therefore a need for engaged, place-based research and knowledge co-production to support them (Cockburn et al., 2020a). Moreover, whilst well-meaning aspirations towards collaborative or more broadly, "participatory," approaches are frequently aired, the deep tensions, conflicts, inequalities and divergences of interests, voices, knowledges and histories that emerge in efforts to manage natural resources differently, are easily overlooked (Wollenberg et al., 2001; Cockburn et al., 2019).

A clearer focus on relationality, as in this paper, is an important nuance in the research on collaboration for sustainable NRM. Important ideas which are being explored with regards to relationality include *care* (Moriggi et al., 2020; Snorek et al., 2022), *trust* (Metcalf et al., 2015) *"with-ness" thinking* (Aamli, 2023), *power dynamics* (Brisbois and de Loë, 2016) and *politics* (Harrington, 2017). Approaching collaboration through the lens of

relationality can deepen our understanding of the multidimensionality of the concept and its enactment, shedding light not only on positive factors such as care and trust, but also on shadow sides involving conflict and contestation.

The focus on relationality specifically in the context of NRM coincides with a so-called "relational turn" in the sustainability science (Mancilla García et al., 2020; West et al., 2020) which has also been evident in the social sciences and humanities, where relational thinking has a long, diverse history (Crossley, 2011; Donati, 2011; Selg and Ventsel, 2020). As Selg and Ventsel (2020) clarify, the difference between relational and non-relational approaches is that relational approaches see relationships as constitutive, i.e., *relationships make things what they are*. The ontological importance of relationships is captured in the realist philosophy which posits that reality is not only multi-layered, but *laminated*, that is, the layers of reality emerge from, interact with and profoundly influence one another (Bhaskar, 2010; Sayer, 2010).

Citizen science and collaborative research

Our case study is an example of two particular approaches to research collaborations or knowledge co-construction in the interest of more sustainable management of natural resources: citizen science (Vallabh et al., 2016; Weingart and Meyer, 2021) and the closely associated community-based environmental monitoring (Conrad and Hilchey, 2011; McKay and Johnson, 2017; Wehn and Almomani, 2019). These approaches have drawn and built on the theoretical frameworks, methodological advances and practical lessons from decades of collaborative NRM, notably community-based natural resource management (CBNRM) (Child and Barnes, 2010) and participatory rural development initiatives in Africa and beyond (Binns et al., 1997; Ahmad and Abu Talib, 2011).

An important intention of many citizen science and community-based monitoring initiatives is for more people to contribute to and benefit from the sustainable management of natural resources, in particular those who have been living on geographical, political and economic margins. Despite these good intentions on the part of scientists, community development facilitators and funders, these pathways towards socially just and sustainable development are strewn with challenges. The nature of these challenges is context specific, and here we focus on Global South contexts.

Studies that documented failures in co-management and other approaches to collaboration in Global South NRM include Child, (2019); Cundill et al. (2013) Cundill et al. (2017), and Cockburn et al. (2019). In a particularly useful meta-analysis of issues affecting sustainability collaborations in Mexico, for example, Ayala-Orozco et al. (Ayala-Orozco et al., 2018) identified six categories of challenges:

1) *Divergent visions and interests*: Different objectives, interests, and ideologies causing tensions across sectors and stakeholders present perhaps *the* central challenge for collaboration;
2) *Methodological and logistical challenges* resulting in what the authors described as poor project management, also hold back collaborations;

3) *Limited participation in decision-making* and inadequate organization or representation seriously hamper collaboration; so does
4) *Poor communication* and lack of suitable information; and finally there are challenges associated with -
5) *Structural conditions*, including the economic and socio-political conditions under which collaborations are meant to take place (Ayala-Orozco et al., 2018).

A recent research report by Rademeyer (2023) demonstrates how many of these challenges play out in South Africa and prevent effective NRM collaborations. Prepared for the European Union funded *Enact* (Enhancing Africa's Response to Transnational Organised Crime) the report is titled *Landscape of Fear*, and details the extent of organised crime, including wildlife crime and specifically rhino poaching, in the Greater Kruger area of the Mpumalanga Province of South Africa. With Kruger National Park (managed by South African National Parks or SANParks, the lead state conservation agency) at its centre, the area also includes numerous privately owned game lodges, bordered by rural settlements where many people live in various states of poverty, with more than 46% being unemployed (Rademeyer, 2023). Here the wildlife economy presents an important opportunity for employment and livelihoods in NRM collaborations.

However, in one instance as many as 70% of people employed to protect nature, are said to be assisting wildlife poachers. What could have contributed to such a stark example of failed NRM collaboration?

The report gives clues that suggest a multi-facetted breakdown in relationships. The Mpumalanga Province features high levels of crime, allegedly organized and politically connected, and enabled by ineffective law enforcement (Rademeyer, 2023), creating what Ayala-Orozco et al. (2018) describe as *public insecurity* and *limited statehood*. Field rangers and other staff are exposed to intimidation by those abetting crime, not only directly but indirectly through their families, most of whom live outside the protected areas.

Rademeyer also documents the expensive militarization strategy chosen by conservation agencies to try and curb rhino poaching in State and private game parks. Field rangers who patrol the areas are "first responders" in encounters with armed poachers. While there is money for the fight against rhino poaching, the rangers are under-resourced and too few in numbers, with unfilled vacancies creating great pressure on those who are in the job.

Furthermore, relations between staff and management are at times characterised by mutual mistrust and suspicion. Finally, the lower ranks of conservation staff are said to be living in sub-standard housing—while billions of donor dollars are available for the military strategy to combat poaching.

All these factors can contribute to experiences of not being adequately valued, protected and respected as a person, a colleague and a contributor, as the underlying mechanisms of a break-down in relationships between actors meant to collaborate towards shared conservation goals. In the development of the BHCDS, and its subsequent implementation review (Rosenberg, et al., 2021) a number of current and former employees in environmental agencies described such feelings of being disregarded, not valued

in one's own right, and forced to fit into unequal power relations, labeling the organisational culture as "toxic." While these concerns are not pervasive, they are nonetheless important to probe further, and for research into instances where effective collaborations were established, so as to identify the contributing factors and understand those underlying mechanisms.

The chosen case study

In this paper we do a secondary analysis of a case of research collaboration through citizen science between government, universities and rural communities, in a project that was, like most NRM collaborations, at times at risk of relationship failures. Through a re-reading of the data collected and analysed by Mtati in 2020, based on her Masters study in the Tsitsa region of South Africa (Mtati, 2020), we identify those relational factors that ultimately assisted scientists to effectively engage rural citizens as environmental monitors, despite the existence of various relational challenges, which will also be identified.

The Tsitsa River catchment (https://www.ru.ac.za/tsitsaproject/) is a remote region (far from urban or industrial development) of the Eastern Cape Province, where most communities subsist on government grants and marginal farming with crops and cattle on communal land under traditional/tribal authority rule. These communities have been engaged by national government through provincial government structures and traditional authorities to undertake land rehabilitation and anti-erosion measures; trial new livelihood options such as cultivating anti-erosion vetiver grass with development scholars (Conde-Aller et al., 2021) and—in the particular sub-project that is of interest in Mtati's study and this paper—collaborate with university-based scientists to monitor the state of the local rivers (Bannatyne et al., 2017).

The impetus behind the latter aspect of the Tsitsa Project, as it has become known, is a proposal from the government to construct dams in the Ntabelanga-Lalini region, with the hope inter-alia of generating hydro-electric energy. Scientists warned that the highly erodible soils of the associated catchments will quickly silt up the dams unless efforts are made to combat erosion (Le Roux and Van der Waal, 2020). This led to a programme of research by several universities, land restoration (with public works teams engaged by the Department of Environment Affairs, DEA) and citizen environmental monitors reporting river silt levels to a research lab at Rhodes University (Bannatyne et al., 2017; Cockburn et al., 2018b). Nosiseko Mtati was appointed as Catchment Coordinator and since she was also a registered student, she conducted a study (Mtati, 2020) into the experiences of the citizen environmental monitors and any benefits they derived from their collaboration with the university-based scientists. Mtati's thesis documents the case study drawn on here.

The case is instructive because the rural parts of the Eastern Cape Province feature many of the structural challenges described in the Mexico review and in Rademeyer's report. These include high unemployment and income inequality; limited development opportunities; deep seated corruption; violent crime and social insecurity. Under these circumstances—and given the apartheid history that can still be traced in the landscape—it is reasonable to assume that citizens will be more concerned about money and employment than about the natural environment, and that they would not share university-based scientists' concerns about

monitoring the sustainability of natural resources, that is, that they would have divergent interests.

Based on the list of factors identified in the meta-review by Ayala-Orozco et al. (2018), the odds were stacked against collaboration in the Tsitsa. However, the Tsitsa Project did eventually feature successful collaboration between university-based scientists and rural residents, in which data was regularly collected, analysed and reported (Bannatyne et al., 2017; Cockburn et al., 2018a), with the citizen environmental monitors themselves eventually leading demonstrations to observers on field trips and joining conference presentations. This case study explores reasons why the collaboration was successful, as articulated by the monitors themselves.

Methodology

The Tsitsa environmental monitors study

The original case study on which this secondary review is based, was undertaken by Mtati (2020). As the Catchment Coordinator her role included liaison between the other university-based scientists and the citizen monitors living 500–600 km away in the Tsitsa Catchment. These residents were speakers of the isiXhosa language and as an Eastern Cape resident and isiXhosa speaker herself, Mtati was well placed in this "boundary crossing" or mediating role (Mtati, 2020).

A case study approach was used to gain depth of insight and rich data on the citizen monitors' experiences in the Project, and the value they derived, or failed to derive, from the opportunity to work with the university-based scientists. Each monitor was treated as a mini case study embedded within the broader Tsitsa Project case.

The total number of Tsitsa Catchment residents employed as environmental monitors by the university (funded by DEA) in the first phase of the Tsitsa Project was 18. Of these 18, 17 monitors (nine women and eight men) were interviewed by Mtati at the end of the first phase, while funding was being sought for the second phase. About one-third of the monitors had been "good collaborators" from the start, while others were slower to respond, or downright erratic as collaborators, and hence instructive to interview. Mtati visited resident monitors at or near their homes, while two of those who have left the area, were interviewed telephonically. She interviewed monitors in their home language and with their permission, translated the transcripts into English. The schedule for the semi-structured interview is available in Supplementary Appendix SA1, with an English-language translation.

Analytical framework guiding the case and the secondary analysis

Mtati used a realist evaluation approach (following Kazi, 2003 and based on Bhaskar, 2010) to map out the context, mechanisms and outcomes for each monitor interviewed. The concept of mechanisms in realist enquiry allows the researcher to go beyond what is empirically observed or directly said by research participants, to probe for underlying, interacting causal powers that give rise to what is empirically observed or stated (Sayer, 2010; Rosenberg, 2020). Realism is a profound philosophical framing for research; it recognizes a depth ontology, that is, that our social-ecological realities are multi-layered and laminated (Bhaskar, 2010), and

that diverse research approaches should be used to develop deep understanding and powerful explanations beyond common everyday knowledge, about these layers (Sayer, 2010). Elsewhere we have outlined the value of a realist approach to understanding the unique ways in which the context of social-ecological sustainability collaborations interacts with mechanisms (or development interventions) to shape outcomes (Cockburn et al., 2020d).

The aim in Mtati's initial study was to understand the environmental monitoring programme within the Tsitsa Project, specifically to answer the following research questions:

- What are the potential and actual benefits for the university-based participants?
- What are the potential and actual benefits achieved for environmental monitors?
- Why are benefits achieved, or not achieved?
- What are the enabling and constraining factors within the programme? (deeper mechanisms)
- What are the educational recommendations for environmental education and training?

Realist research is not a particular technical procedure but a logic of inquiry. In realist studies of programmes, the logic is that there is an underlying theory to the programme which can be improved, by answering the questions: what works, for whom, in what circumstances (contexts) and why? Kazi (2003) described programmes as open systems within which underlying mechanisms are activated to result in particular programme outcome patterns. To assist in finding and grouping relevant mechanisms, Mtati reviewed the literature on citizen science and used a framework developed by Phillips et al. (2018) which she adapted as her findings started to become evident. This framework categorized the benefits (outcomes) of citizen science for participants as: self-efficacy; skills of science; content, process and nature of scientific knowledge; interest; motivation; and behaviour and stewardship.

The realist analysis explained *how* mechanisms that unfolded in the Tsitsa Project interacted with, or failed to interact with, other causal mechanisms in relation to the monitors and their contexts. In the process, Mtati learned what the monitors valued, and how these values were achieved, or not achieved.

For the secondary analysis we did a re-reading of Mtati's data through the relational lens outlined in the literature review above, with particular reference to collaboration challenges and failures identified in the meta-review conducted by Ayala-Orozco et al. (2018) and the *Enact* report by Rademeyer (2023). The lens helped us to focus on the types and qualities of relationships that featured as relevant mechanisms or causal powers influencing collaboration processes.

Mtati's raw data in the form of 17 interview transcripts is available on request. The data extracts from Mtati's analysis are captured in Supplementary Table S1, which is attached as Supplementary Appendix SA2.

Findings and discussion

What river monitors valued, and why

Collaboration in aid of NRM was not a given among the Tsitsa residents. When the university partner approached residents living in the catchment, and specifically near the Tsitsa River, with the offer to pay them to take river water samples and do *in situ* observations to help monitor siltation, not all citizens accepted the offer. Some initially did, but at some point later, in one way or another, they thwarted the collaboration, for example, by failing to collect samples regularly, reporting spurious data, or absconding with project equipment. But other Tsitsa residents *did* become effective partners in the research collaboration. What relational factors "worked" in these instances, and what do we learn from this, that might help us understand effective sustainability collaborations?

Of particular interest to Mtati, and to other Tsitsa Project members at the university, was whether the stipend paid for the sampling was the sole driver of the collaboration for the monitors. After all, unlike many citizen science projects studied in the Northern Hemisphere or Australia (see, e.g., Rotman et al., 2014), the Tsitsa River catchment residents did not themselves decide to start monitoring their local river because they had a particular interest in the environment, such as bird watching or pollution reduction. And indeed, the interview data indicates that payment was important. As one resident explained: "*In our days people do not want to work for free. People want to get something in return, not just a thank you, there must be something to get in return.*"

Mtati's study showed that becoming environmental monitors and collaborating as citizen scientists with university-based scientists to produce NRM knowledge, created both tangible and intangible value for the participating Tsitsa residents. Benefits did include the money earned, but also several intangible benefits, including the joy of (re)connecting to nature; having purpose; friendships; being stimulated; and being part of an inspiring endeavour—that is, relationships. The interview extracts below (and summarized in Supplementary Table S1, in Supplementary Appendix SA2) show that even the financial benefits described by the monitors can be understood through the lens of relationships: being able to provide for self and others, status and (new) role in family or other relationships, as a contributor, a person with something to offer.

Tangible benefits

Money or what the monitors called *imali yamanzi* (river money) was the most frequently mentioned benefit of being a monitor. Money assisted these rural residents in various ways. Monitors reported using the new income to support themselves and their families (e.g., children's education and food); to buy clothes and household items (stoves, cupboards, washing machine, kitchenware), and joining a *stokvel* (women's group who saves money for customary end-of-year expenditures, especially Christmas time when relatives who have left the rural area to work or school in the city, return to the family home). Some mentioned building a house or adding to the homestead by buying a rainwater tank, for example,.

The "river money," for some, contributed to diversified livelihoods in the form of small businesses. Examples were buying a sewing machine and start-up material for a sewing business; while another woman revived her business selling clothes.

In Natural Resource Management programmes in South Africa, there has been a debate on whether environmental monitors should

be engaged as volunteers or paid. This is an important question, as citizen science could create much needed employment, but payment could also reduce the intrinsic motivation to participate in environmental protection. Raworth (2017) explored how the introduction of cash can have both a positive and negative influence on beneficiaries' responsibility towards a common-good resource like the environment. She demonstrated that money has the potential to erode social norms (like pride) and that once these are replaced by market (cash related) norms, it is difficult to reverse the effect. In the Tsitsa Project, however, Mtati's study showed that payment to environmental monitors did not necessarily *replace* relational values, but could in fact be important precisely *because* of relationality, as we explain next.

Among the younger monitors, the money boosted their confidence in that they could contribute financially within their families; one interviewee used the powerful expression *yandenza umntu—"I became a person."* Some young monitors became more independent; and mentioned that they could "keep their girlfriends happy." Being able to contribute at home has several benefits: family members show one more respect, one gains confidence and can start to contribute to decision-making in the family. Through the relational lens, it is easy to realise the multi-dimensional roles of money, many of which have at their heart, relationship status and responsibility towards others.

Similar findings were reported by Swemmer et al. (2015) in the Kruger to Canyons Environmental Monitors programme in the north-east of South Africa. These authors reported that the most significant impact of being employed, for environmental monitors, was the respect given to the individual by their families and community members. Swemmer et al. also found that the most popular part of the environmental monitoring job was the training (a basic environmental monitors course) along with workshops about the environment and working with computers. Training helped monitors to do their jobs more effectively, and potentially empowered them for future jobs. The least enjoyed monitoring tasks were those in which they felt they did not learn anything or could not see the relevance of what they were doing.

Intangible benefits

In the Tsitsa Project, one of the more surprising intangible benefits was that becoming a monitor meant for some that one had to manage one's time well, planning one's days around sampling, which meant that there was "no time to gossip," something these interviewees regarded as a bad habit. The job gave them, as people without formal jobs, something to do and a sense of purpose.

Some monitors reported that in the period following the end of the first funding phase, they "felt lost" without the monitoring job, using terms that suggest a loss of meaning and purpose. Although the job was finished by the time of the interviews, some former monitors reported that they continued to go to the river, where they would reminisce or take random pictures as they had done when they were still employed: "*I usually go to the river when it has rained and think of the times I was working there.*"

Monitors also valued the knowledge they had gained through their involvement in the project; and for some their interest in the river had increased. For example: "*It made me much more aware of how the river works and all the changes and influence it has on the banks big water and dry times. So it made me much more attentive of my natural environment as such.*" The project was thus a way for these monitors to (re)connect with their surrounding environment, and they valued this enough to mention it in the interview.

Monitors expressed their feelings towards the project in which they collaborated using phrases like "*enjoyment,*" "*liking it,*" "*loving it*"; "*feeling lonely when not sampling.*" They appreciated friendships with the researchers, field technicians and other monitors: "*I think the friendship, I call that a benefit. I got to meet a lot of interesting people from the university.*" Some found it "*inspiring to see people that work on projects that are relevant and that can change a lot of things for good.*"

Some among those who never had a job before, developed greater confidence in themselves, their self-esteem being boosted by realising they are capable of doing a job well. The monitors also appreciated the shared respect between themselves, the field technician and the scientists from the university. Respect emerged as an important factor either enabling or reducing monitors' decisions to collaborate in the project (see below).

This resonates with the findings of Swemmer et al. (2015) who reported the value of the respect that the Kruger-to-Canyons environmental monitors received from families and community members once employed. These monitors also appreciated being taught to be responsible, which has given them a sense of pride, self-esteem and confidence. Other researchers studying citizen science projects have also identified a sense of contribution, community, as well as personal enjoyment, gaining knowledge, new perspective and the opportunity to participate in science, as valued outcomes (Jordan et al., 2011; Crall et al., 2012; Hobbs and White, 2012; Jordan et al., 2012). Rotman et al. (2014) found citizen scientists' motivation to be initially driven by interest, but also by feeling socially responsible. Elsewhere people participated in citizen science initiatives for the opportunity to connect with nature (Bell et al., 2008). We did not anticipate this to be a factor for the Tsitsa monitors, who live in a rural landscape of rolling grasslands and spectacular mountain vistas. However, some monitors did reflect that going down to the river to observe it and collect samples, has heightened their awareness of the river and created an experience that they missed, once the project was over. An appreciation of the place was evident—and this was notably not replaced by being paid to attend to the river, but rather facilitated by it. Mtati (2020) argued that this heightened awareness of place and connection with the natural environment could be early steps towards stewardship. Lawrence and Suddaby (2006) supported the idea that environmental sampling contributes to the relationship between person and place or natural objects and may affect the values of citizen participants.

Project factors that enabled research collaboration in the Tsitsa Project

In citizen science initiatives, the motivation of the participants to stay involved or keep collecting data (which may interfere with other responsibilities and activities) plays a big part in successful projects. Mtati's interviews with Tsitsa monitors surfaced several factors that were significant in their continued participation and which were directly related to how they were approached and treated, including:

- in their own language (at least at the first meeting, until enough goodwill was established to continue conversing in a mix of languages);

- with respect for their customs, personhood and situation (for example, recognizing meeting and visiting customs, and recognizing that monitors could not cover project running expenses themselves);
- with care to explain the job (not only explaining the sampling procedures once, but being available to ask follow-up questions once sampling is underway); and
- in relationships that were sustained (being available on the phone, re-visiting the catchment whenever possible, engaging even when it was not needed for project purposes, and inviting monitors to other project activities like conferences).

Elsewhere we demonstrated that research collaborations in the Tsitsa Project led to the formation of more lasting and extended relationships among the collaborators, including government officials, academics, university students and residents (Cockburn et al., 2018a; see also Palmer et al., 2021). For example, when violence in the form of housebreaking with assault was visited upon Tsitsa community members, project members from outside the catchment rallied to their side. This was one of several examples of new relationships that were established through the Tsitsa Project, but also sustained beyond the requirements of technical collaboration. Another such example was that after a second round of project funding had come to an end, the former monitors invited Mtati back to visit, "even if you do not get more funding."

Mtati's study also surfaced the importance of the university-based scientists *following up* with the catchment-based monitors after the initial training on how to sample and do observations; and *being available* to answer questions and trouble-shoot as monitoring unfolded over the ensuing months. While these are seemingly simple measures, they are also easily overlooked. Giqwa (2018) and others have shown that skills development in some public works programmes is poorly conceptualised and executed.

Other authors who found these factors to be important include Rotman et al. (2014) who noted that the citizens' relationship with the project was important for creating grounds for trust, recognition and mentorship. Crall et al., 2012 recommended fostering long-term community-level involvement activities with under-represented audiences, also emphasizing that sustained relationships are important. Emphasizing the importance of these factors, Devictor, Whittaker and Beltrame (2010) created a framework for designing citizen science programmes that would foster knowledge exchange and relationships, resulting in sustained programmes and good data.

Challenges to collaboration and overcoming them with relationality

The Tsitsa Project encountered several of the challenges that thwarted collaboration in Mexico (as reviewed by Ayala-Orozco et al., 2018, p.6). There were logistical challenges, e.g., the project was some 450 km away from the university, necessitating a six to seven hour one-way trip by road each time researchers visited the catchment (see Figure 1). Installing and maintain the research equipment as well as communication tools for residents to send data to the university, was challenging

in this environment with limited connectivity and other amenities. A large part of the trust relationship was established through the way in which monitors were entrusted with equipment like smart phones.

Communication between the predominantly English-speaking university-based scientists and the predominantly isiXhosa-speaking catchment residents was one of the most talked-about challenges in Mtati's interviews with monitors, and here it was noted that the monitors valued researchers attempting to speak the local language, after which the locals felt more comfortable to continue in English. The presence of boundary crossers such as the Catchment Coordinator who could converse in both languages and assist not only with translations, but even more importantly with helping all parties to feel comfortable with each other, was a key relational factor.

Over time, as the researchers engaged in the Tsitsa catchment, they realized the extent to which the rural residents, in particular women and youth, have little *opportunity to participate in decisions* that affect them, being subject both to tribal authorities and a far-removed national government, and still marginalised by the socio-economic and spatial legacies of apartheid. Every effort was then made to assist them not only to attend meetings, but to actively participate in them. This included consideration of where and when meetings were held, providing transport, and running workshops that explained scientific terms in the local language (Palmer et al., 2021). This also addressed the common challenge of *not enough appropriate information* that thwarts effective collaborations.

Given the differences in the *structural conditions* (social, cultural and economic in nature) between the university-based scientists, and the rural residents of the Tsitsa catchment, as well as the historical trajectories of environmentalism in South Africa as described by Khan (2000) and others, it was not far-fetched to assume that there would be irreconcilable differences in their respective objectives, interests, and ideologies, such that no meaningful collaborations (working together on river monitoring) could take place.

However, Mtati's study suggests that rural communities readily share with scientists many common human values: valuing family, interpersonal and customary respect, social standing through contribution, friendships and stimulating work, pride in a job well done, and even—significantly for the focus of this journal—an interest in the environment, albeit in the form of looking at what is for rural residents deeply familiar, with new eyes.

Mtati found that disrespectful approaches turn young people away from and ultimately against initiatives intending to benefit them. For example, one monitor stated that bosses need to respect their employees, because without them, the job cannot be done. Disrespect was experienced by this same monitor when the reasons for the loss of a project phone was queried by the project manager. When the second phone also disappeared, the monitor was reported to the tribal authorities and this he experienced as a sign of distrust and disrespect, bad enough to drop out of the project. Incidentally, he did not attend the tribal *indaba* to discuss his ability to stick to the project protocol. This example shows that trust and respect are reciprocal features of relationships, and all participants have responsibility for them.
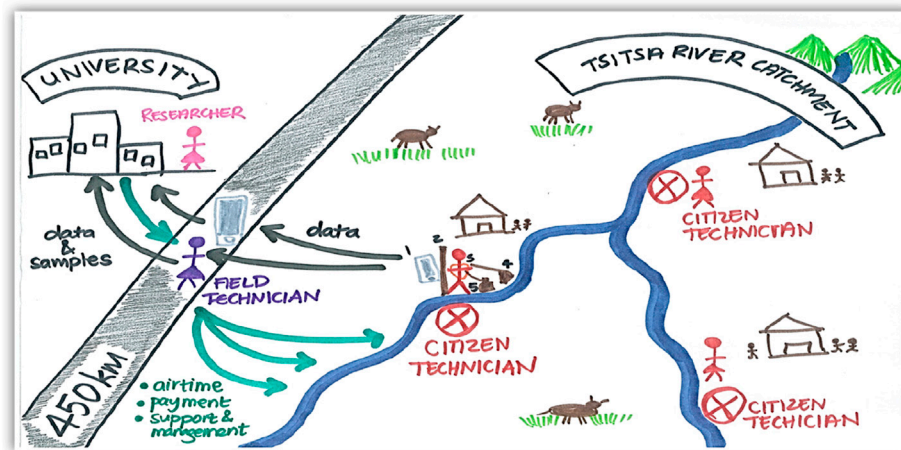
FIGURE 1
Logistical and communication considerations in the Tsitsa Project.

Conclusion: respectful and caring relationships matter

The manner in which relationships stood out as a significant mechanism or causal power (Sayer, 2010) in the Tsitsa research collaboration echoes and reinforces the shift in the sustainability sciences towards relationality described by West et al. (2020) as a relational turn. While relationality is not necessarily news to social scientists (e.g., Emirbayer, 1997), it helps explain our practice-based insights on the value of careful relationship-building for more sustainable and just natural resource management. It also suggests a hypothesis worth exploring in future research: That expanding efforts to build collectives of monitors, rehabilitators and other natural resource custodians, may present a methodology to build relationships and livelihoods that could in turn discourage and dislodge environmental crime and corruption.

We do not claim that all relationships in the Tsitsa are or were smooth or respectful, and shared an example of a breakdown in relationships around lost project equipment. The point we wish to pursue is that shared custodianship and benefit sharing in NRM might be a viable pathway to diverse livelihoods and environmental sustainability, but only if partners give careful attention to *the ways* in which rural citizens—whether river monitors or field rangers—are approached, capacitated and resourced. The *manner* in which people are engaged so as to initiate and sustain collaborations is not negligible, but can be overlooked in the face of research project deadlines, reporting requirements or budget constraints.

What else is needed to achieve sustainable development through collaborative natural resource management? State failures and public insecurity have been shown to thwart collaboration efforts not just in Mpumalanga but around the world, where new approaches to multi-stakeholder landscape management in the context of crime, conflict and eroding governance are much-needed. Given that collaboration would be essential in order to improve unequal, insecure situations, agencies with developmental goals such as engaged universities, must find ways to maintain collaborative working relationships despite the odds stacked against them by weak governance and gross economic inequality.

It is thus worth researching and promoting measures, processes and dispositions that can maintain good working relationships among actors from diverse backgrounds and with vastly different circumstances.

Drawing on insights from the research into the NRM sector's transformation needs in South Africa, the international literature and local reports, Mtati's research on the Tsitsa monitors, and other reviews of engaged transdisciplinary cases in the Global South (Wolff et al., 2019; Cockburn et al., 2020a; 2020b; Cockburn et al., 2020c), we identify relational factors that helped scientists to effectively engage rural citizens as environmental monitors, despite the existence of divergent interests, methodological and logistical challenges, and structural challenges. This leads us to argue for more of the Tsitsa Project's low-key "good practices" that emphasised relationship building, and created trusting networks of social actors working together for livelihood opportunities and a common good.

In a small way we also contribute to the literature on suitable methodology for studying collaboration in NRM and other transdisciplinary contexts. Like realist methodologists (Sayer, 2010; Rosenberg, 2020), complexity theorists working with social-ecological systems theory (Preiser et al., 2018) describe relationality as a defining feature of complex adaptive systems, noting that social-ecological systems are what they are by virtue of the multiple, dynamic relations or interconnections which link the elements of a system together. What this means for studying collaboration for sustainable NRM then, is that we are interested in collaboration not just as a goal or outcome, but that we are interested in the nature and quality of relations among human actors in the system, recognising that these constitute the very nature of the natural resource management system of interest. As Ison argues, "We inhabit a world that focuses on "thingness" rather than the other side of the distinction, in this case the relational dynamics. This propensity is pervasive and debilitating" (Ison, 2016: 596). A realist and relational approach enables us to look beyond the things in a system, to relations and relational processes as causal powers.

Data availability statement

The raw data supporting the conclusion of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving humans were approved by Rhodes University Faculty of Education Research Ethics Committee (EF-REC). The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study. Written informed consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article.

Author contributions

ER co-conceptualized and co-supervised the primary research; conceptualized this paper and wrote 75% of it. NM co-conceptualized and conducted the primary research under supervision of ER and JC, contributed on the methodology section and reviewed this paper. JC co-conceptualized and co-supervised the original research, wrote 25% of the present paper

and reviewed it. All authors contributed to the article and approved the submitted version.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fenvs.2024.1243653/full#supplementary-material

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