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AUTHORS:

Carolyn G. Palmer¹
Jane Tanner¹

AFFILIATION:

¹Institute for Water Research, Rhodes University, Makhanda, South Africa

CORRESPONDENCE TO:

Carolyn (Tally) Palmer

EMAIL:

tally.palmer@ru.ac.za

HOW TO CITE:

Palmer CG, Tanner J. What does practising the Adaptive Systemic Approach offer engaged sustainability science? *S Afr J Sci.* 2024;120(9/10), Art. #19355. <https://doi.org/10.17159/sajs.2024/19355>

ARTICLE INCLUDES:

- Peer review
- Supplementary material

KEYWORDS:

complex social-ecological systems, radical honesty, transdisciplinarity, water resources

FUNDING:

UK Research and Innovation (ES/T003731/1, ES/T015330/1)

PUBLISHED:

26 September 2024



What does practising the Adaptive Systemic Approach offer engaged sustainability science?

Significance:

Engaged sustainability science is a relational response that mobilises knowledge into constructive action. However, theoretical and conceptual development has outstripped effective practice. Some of the barriers to practice include: (1) integrative theories, concepts and vocabulary that are not familiar to most disciplinary scholars; (2) literature that supports these perspectives is dispersed and difficult to organise into practical steps; (3) the skill-set for effective engagement is rare, and includes facilitating co-learning that is attentive to power and equity. By providing a clear set of activities, the Adaptive Systemic Approach enables novice and experienced research practitioners to start, and to follow a pathway.

Introduction

The sustainability crises of the 21st century will not be addressed by academic knowledge alone, and certainly not by discrete disciplines. This recognition lies at the heart of engaged sustainability science. There is clear evidence that the ‘wicked’ problems that beset the earth’s complex social-ecological systems, require multiple, concurrent interventions informed by diverse knowledge forms.

The Adaptive Systemic Approach (ASA) was designed by teams of researchers from across Africa, to provide a clear pathway for sustainability research to effect change towards improved ecological health and social justice.¹ The teams were assembled through the African Research Universities Alliance (ARUA), which placed the Water Centre of Excellence in a ‘science’ research stream, so the initial members were natural scientists (aquatic and landscape ecologists, botanists, hydrologists, and water or agricultural engineers), only a few of whom were experienced in sustainability science.

Here we show how the African research teams took the initial conceptualisation of the ASA, and, through a collaborative project entitled ‘Unlocking resilient benefits from African water resources’ (RESBEN), learned ways to advance engaged sustainability science practice. RESBEN addressed the intertwined problems of freshwater scarcity, impaired water quality, and declining ecosystem health, and was organised through a hub/lead university team from South Africa, with ‘node’ teams from Ethiopia, Senegal, Nigeria, Uganda, Rwanda and Tanzania, and three researchers from the UK.

RESBEN was ambitious, and we were naïve – even those of us with transdisciplinary, engaged research experience. As we encountered setbacks and challenges, we realised we had to constantly review our work ‘warts and all’. In messy engaged research projects, processes and outcomes are often ‘back polished’, but we decided to resist this approach and rather to engage as a team with ‘radical honesty’ – the open acknowledgement of, and reflection on, limitations and failures.

The ASA practice was uncertain and non-linear. Through time, teams recognised three main characteristics. (1) There is a ‘bubble’ (community of practice) of scholars familiar with engaged sustainability science vocabulary, concepts and practice. Most RESBEN researchers were outside the bubble. It took much longer to become familiar than we had anticipated. (2) The ASA provides a flexible architecture that supports practice and allows for learning and adaptation in the face of disruptions. (3) The architecture is only effective when there are mechanisms – developed through team capability building – that ensure that participants experience being respected and have adequate vocabulary and confidence to share their knowledge and to learn. Mechanisms attentive to epistemic (in)justice (un/fairness in terms of knowing) are: (i) your knowledge being respected and (ii) having sufficient additional knowledge provided to participate effectively² (Figure 1).

The ASA: Concepts familiar in the ‘bubble’ architecture, and mechanisms of practice

The ASA had three, and later four, foundational concepts that provide a basis for practice.

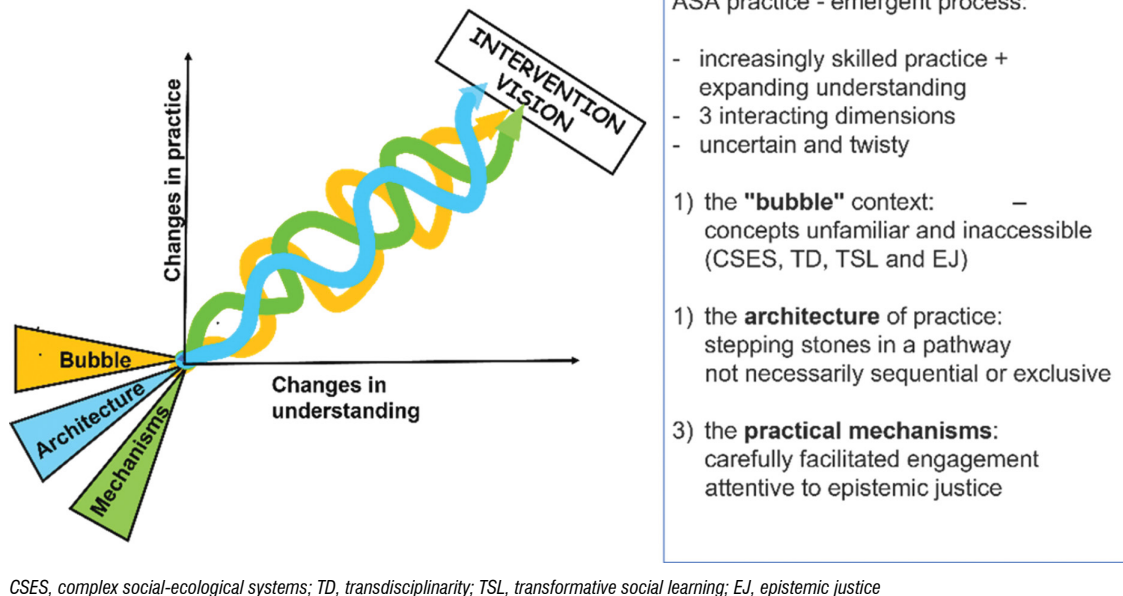
Complex social-ecological systems

The world is understood to consist of linked, intertwined, and interactive social and ecological systems that behave as complex systems.^{3,4} They comprise many elements, linked by interactions that feed back to elements and other interactions, in an endlessly adaptive way. The interactive processes are unpredictable, non-linear and are influenced by scale and system history. Intervention outcomes can exceed or be the inverse of effort and investment. It is imperative to take account of context. As a result, intervention pathways *are* twisty and uncertain, and *progress is adaptive and towards* a planned outcome or state – rather than *achieving* a specified outcome or *solving* a problem.

Transdisciplinarity

Transdisciplinarity⁵ is a commitment to respecting and including people with the widest possible range of knowledge forms (scholarly – from the widest relevant range of disciplines, indigenous, personal, practical, and professional) and using knowledge responsibly and inclusively to address intractable problems. (For details of RESBEN’s disciplinary scope see Palmer et al.¹)

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CSES, complex social-ecological systems; TD, transdisciplinarity; TSL, transformative social learning; EJ, epistemic justice

Figure 1: Through time, the REBEN teams experienced the way in which the three aspects of the Adaptive Systemic Approach (ASA) – recognising the bubble, following the architecture, and learning the practical mechanisms of skilful facilitation – interacted, enabling more nuanced understanding, and progress, in a twisty and uncertain manner, towards the vision of the research intervention planned in each of seven African countries.

Transformative social learning

Transformative social learning⁶ involved mobilising knowledge to enable co-learning among groups of people, often through collective action and collaborative activities. Transformation emerges in the relationship between changes in understanding and doing.

Epistemic justice

Epistemic justice⁷ means fairness in relation to knowing. When people participate in engaged sustainability activities, epistemic justice depends on each person experiencing being respected, and having sufficient understanding, knowledge, vocabulary and confidence to both take in new knowledge and to share their knowledge.

Following the pathway

There also are other complementary concepts, framings, and methods that are well aligned with the ASA and can add value. Examples include critical realism, nexus thinking, systems thinking, value creation, and causal loop diagramming.

The architecture of the ASA is a set of phases and stages that support and enable the strategic adaptive management of complex social-ecological systems (Figure 2). By providing a set of sequential and concurrent activities, the ASA enables novice and more experienced research practitioners to start – and provides a guide and pathway to follow. Although it is not prescriptive, our practice has found that the ASA phases work; they are detailed in Palmer et al.¹

The ASA journey

In this section, we work through the REBEN timeline, commenting on the way that key selected engaged activities, in and across countries, progressed us along the interactive pathway shown in Figure 1. We underline the six (deceptively simple) insights that practising the ASA offers to sustainability science. We present this as a timeline to reveal path dependency, emergent properties and feedback in the REBEN project system.

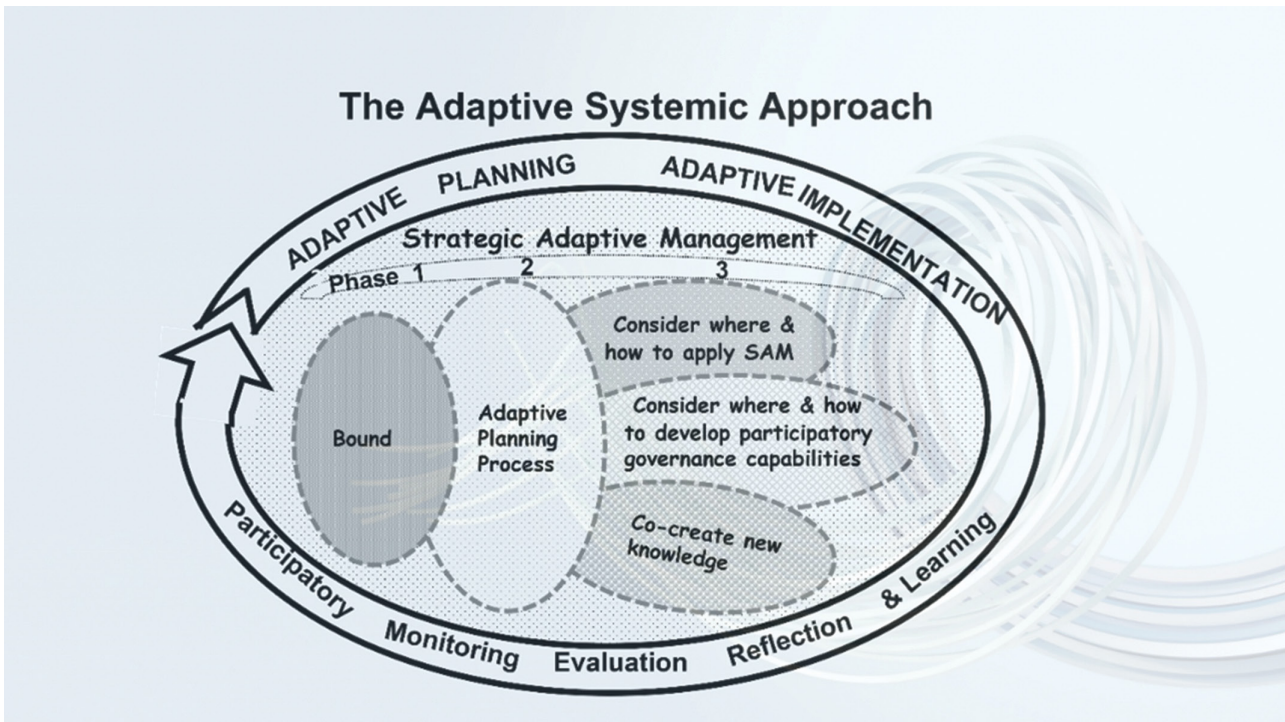
In **February 2017**, the teams of researchers met each other face to face for the first time at the Water Centre of Excellence launch, which included a four-day workshop. Shared languages included English and French – and translation was available. Drawing on facilitation skills learned from epistemic justice-attentive Strategic Adaptive Management⁸, the group was guided to co-develop a conceptual map of our agreed research practice (Figure 3) – the forerunner of the ASA. We also socialised and

built interpersonal relationships. These four days were to prove a vital relational foundation.

At this early stage, we agreed to: a complex social-ecological systems framing; seeing research as a process to grow knowledge *and* benefit people; and to understanding healthy ecosystems and ecosystem services as supporting human well-being. We had little grasp of what it would take to actually *do* this.

From **March-December 2019**, REBEN researchers collaborated to develop proposals, and were awarded two grants to develop research capacity and capabilities, and to apply the ASA in seven African countries. Each country-based case study was selected in a complex social-ecological system with established stakeholder relationships, and a sound contextual understanding.¹ Stakeholders explicitly spanned government, civil society, NGOs, residents of the complex social-ecological system, and private enterprise. They were initially identified by the research team during Phase 1, 'Bound' (Figure 2), and were added incrementally throughout the project. Stakeholder relationships were deepened at the interactive workshops. It is worth taking/making as much time as possible to build trusted relationships. Relationship dimensions include personal, professional, scholarly, and practical interactions, within teams, and with stakeholders.

In **March 2020**, the hub team developed a short course and organised a four-day ASA training workshop in Ethiopia, for lead researchers from all the nodes. The course was well received, and we did not realise at the time that what was presented was "too much too fast" (Ugandan researcher). At that stage, we envisaged that REBEN would unfold as a series of workshops for each of the ASA phases, in each country, and that hub researchers, experienced in ASA concepts and facilitation, would lead workshops as vehicles of learning by doing. The COVID-19 pandemic intervened and face-to-face meetings and travel were suspended for two years! At the time, we did not realise how thin understanding was of complex social-ecological systems, transdisciplinarity, transformative social learning and epistemic justice. This was the first of iterative 'training of trainers' work sessions in which experienced hub researchers worked through concepts and processes with country-based researchers, who designed and planned their APP workshops to suit their context, and actively practised new skills. Each activity was reflexively discussed, and co-learning was explored. Now, four years later, most REBEN researchers remain disciplinary specialists, but they are willing and able to collaborate in transdisciplinary engaged projects, in an informed and generative way.



Source: Palmer et al.¹ (reproduced under a CC BY 4.0 licence)

Figure 2: “Schematic of ASA [Adaptive Systemic Approach] showing phases of the process and learning cycles, with iterations indicated in a forward spiral.”

Intentional transdisciplinary research for a sustainable African water future

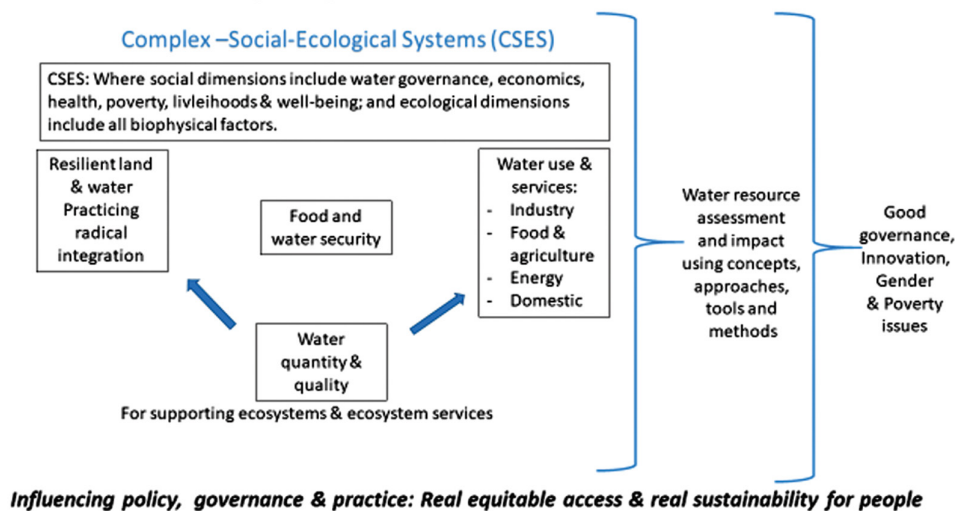


Figure 3: Forerunner of the Adaptive Systemic Approach (ASA), a conceptual mapping of agreed research practice among ARUA Water Centre of Excellence researchers.

Between April 2020 and April 2021, we confronted the enormity of the pandemic disruption. The ASA way of working is informed by principles of practice⁹, of which ‘manage discontinuities’ is the one that is repeated at different degrees of severity in every engaged complex social-ecological systems project. RESBEN had to be re-planned several times, affecting key processes.

i) **Students:** RESBEN had (at least) one science and one social science graduate student in each node. Their research drove ASA Phase 3 to “co-create new knowledge” (Figure 2). Their projects were reformulated and initiated immediately to ensure graduation. ASA engaged workshops could not start. This created a discontinuity gap between research focussed on case study problems and the

processes of knowledge co-creation with stakeholders. Once students could do field work, their one-to-two-year projects made invaluable connections with stakeholders.

ii) **Social science:** We started with ‘science-heavy’ research teams. With a clear transdisciplinarity intention, we envisaged the lead social science researcher and a postdoctoral researcher from the UK overseeing social science students observing ASA workshops and formulating research questions related to ASA practice, with the opportunity for cross-case comparisons. Despite transdisciplinarity as a foundational concept, this was a fundamentally inadequate way to properly integrate natural and social sciences.



We belatedly located social science supervisors for social science students, but without budget allocations, and face-to-face engagement, there was a disconnect between node social science researchers and the project. It became clear that social science students needed methodological support, and the UK postdoc ran an online methods training programme.

We used ‘power’ as a linking concept, and ran an online power workshop – but it did not ‘land’. Gradually we became aware of the magnitude of the divide between natural and social science sensibilities, theories, and methods. We underestimated what was needed to build bridges to grow understanding and interdisciplinary, and then transdisciplinary, knowledge. (Details of the case studies and research team are in Palmer et al.!) There were RESBEN researchers who remained dismissive of transdisciplinarity in the ASA, favouring ‘hard’ science. Among the willing natural scientists, there was still little understanding of what constitutes sound social science data collection and analysis – and the time and effort required to achieve this. Although RESBEN provided a social science methods course, and mentoring, for students and research assistants, this proved inadequate. The gap of omitting social science researchers from country-based teams at the start was too great to fill.

iii) *Funding*: Project funding was drastically cut, requiring radical replanning. This was discouraging and profoundly disruptive. It was at this stage that the depth of commitment and trusted relationships kept the project alive.

1. **Discontinuities are inevitable in complex social-ecological system projects (an emergent property of their complexity), creating disruptions of variable magnitude. Resilience comes from dogged perseverance, a pragmatic commitment to adaptation, and investment in trusted relationships among team members.**
2. **Real, deep, natural–social sciences integration is exceptionally difficult. This a frontier in engaged sustainability science. Understanding integrative concepts is required but insufficient. We still need to discover ways to robustly integrate social and natural sciences so that concepts, theories, methods, assumptions, vocabularies, ethics and sensibilities are shared, learned and respected.**

Between May 2021 and May 2022, country-based teams undertook the work required for the ASA phases. The ‘Bound’ phase should have resulted in a comprehensive social and biophysical contextual report on the ‘problem system’ to be addressed. (The term ‘bound’ indicates the porous boundaries of complex systems and the need for their delineation.) The social context should have included stakeholder mapping related to the problem being addressed, and initial stakeholder engagement initiated, so that stakeholders would be included as early as possible. Most reports were thin, and little stakeholder contact was evident – partly because of the pandemic. These reports were the first indication that the ‘idea’ of the ASA was not deeply understood and embedded.

The next phase was to assemble stakeholders identified in the ‘Bound’ reports, in an Adaptive Planning Process (APP) workshop (Figure 2) – which preferably should be over at least two days. (Stakeholders were identified by research teams based on their complex social-ecological systems contextual knowledge. The research teams sought stakeholders related to case study questions, paying attention to including participants from government, private enterprise and civil society – especially complex social-ecological systems residents.) There were formidable obstacles. Budget, time, and travel constraints led to adaptation. Node researchers gathered at the hub university, and we ran an APP ‘training of trainers’ work session, so that country-based researchers could lead and facilitate their own APP workshops. Training exposed researchers explicitly to facilitating in ways attentive to epistemic justice.¹⁰ This was the first of iterative ‘training of trainers’ work sessions in which experienced hub researchers worked through concepts and processes with country-based researchers, who designed and planned their APP

workshops to suit their context, and actively practised new skills. Each activity was reflexively discussed, and co-learning was explored.

One or two hub researchers travelled to support APP workshops now run by country-based teams. The effort to grow facilitation and engagement skills proved to be a better outcome than the originally planned hub-run workshops.

3. **Iteration is essential. Nuanced understanding and confident, careful facilitation only emerge with practice. Collective training and practice catalyses co-learning.**
4. **Facilitation that is attentive to epistemic justice is a core skill required for engaged sustainability research.**

After in-country APP workshops were completed, the whole team engaged online in an ‘APP debrief’, where outcomes were shared, and researchers learned from each other and discussed what ‘worked’ and what did not. This is where we drew on interpersonal trust, abandoned ‘back-polishing’, and accepted messiness. We experienced the need for, and benefits of *radical honesty* – acknowledging failures, and exploring ways to adapt. This was not easy. Time for reflective, honest debriefing conversations, and the of collection written and verbal reflections (elicited from carefully crafted questions) became vital tools for co-learning and discerning where value was created.

As APP workshops progressed, the hub team prepared a ‘training of trainers’ workshop for ASA phase 3, Strategic Adaptive Management (SAM) workshops – again facilitated by in-country researchers, with hub support. The aim of SAM workshops was to work again with stakeholders who, in the APP, had collectively co-developed a vision for the future of their complex social-ecological systems – and produced a set of linked objectives, with commitments to action, to move towards the vision. Stakeholders were reminded of their APP outcomes and alerted to the opportunities offered by adaptively moving toward an envisioned future.

In some cases, the SAM workshops brought a wider range of stakeholders together. Part of the facilitated workshop experience is that of sharing your knowledge and learning from others, and often being surprised at what you learn from whom. The benefit of facilitation that is alert to epistemic justice, is the creation of opportunities for listening, speaking and learning to occur among stakeholders who seldom encounter one another. Some of the mechanisms include using first names not titles, giving everyone a chance to contribute and recording their actual words on sheets put up on walls – creating the experience of being heard, and eliciting responses randomly, taking care to mix the order of conventionally senior people with others.

We found it particularly useful to run a ‘learning words’ session¹⁰ with rural village participants, in their home language, before a more formal SAM workshop day. The community participants were encouraged to share their knowledge of the complex social-ecological systems in which they lived and derived their livelihood. They learned that the participants they would meet the next day would be less familiar with the place, and could learn from them. They in turn learned natural resource management terms previously unfamiliar to them, that they would encounter the following day at the SAM workshop. At the SAM workshop, the confidence of community participants and the willingness of government officials to share, listen and learn was unusual.

There was an explicit aim to expose stakeholders to the possibilities of participatory governance – where government includes stakeholders in planning and decision-making in the complex social-ecological systems of interest. The involvement of a wide range of stakeholders in the governance and management of complex social-ecological systems is rare – and where it exists is usually hierarchical, with evident power imbalances and exclusions. The SAM workshop acts as a learning catalyst to encourage movement towards participatory governance.

5. **Use a local language whenever possible, and translation when it is not, to ensure fair co-learning opportunities. Facilitate co-learning by arranging to expose participants to the vocabulary likely to be used in the workshop – and unlikely to be familiar to them.**

Between June 2022 and June 2023, the SAM workshops were completed, and the team committed to writing a set of papers for a special feature in a scholarly journal. We all met in Uganda for a final week of collaborative work. Again, the hub team carefully prepared a set of engaged activities for the teams and facilitated this final Integration Workshop. We asked ourselves the questions: What has practising the ASA in RESBEN contributed? How do we present these contributions in a scholarly manner?

The week was extraordinary. On the banks of Lake Victoria we worked to share what we had learned. We listened to our own stories of struggles, successes and failures at different times throughout the project. We articulated recognising the 'bubble'. We heard about the pressure of trying to work in a new way – to gather data in new ways, and to participate in the organisation and delivery of a large complex project. "When I saw an email from the project leader I closed my laptop and pretended it was not there. I could not read it for days." (Ethiopian researcher). We discussed the principles of practice that had emerged, and were excited about innovations in formal integration and the use of value creation to record research impact in a more nuanced way. For these details, the reader must wait for publication of that special feature.

6. **It is hard to write robust scholarly papers about messy engaged projects. But we must, and we must be honest about the realities and challenges of achieving an impact. We must also communicate generously and reflexively (academic literature, popular and social media, blogs and policy briefs, radio, television) to grapple with the challenges of engaged sustainability research, learning from each other as we go.**

Acknowledgements

We acknowledge the African Research Universities Alliance (ARUA), and specifically the ARUA Centre of Excellence in Water, which is made up of a network of nine African institutions that contributed to this research. Professor Frances Cleaver and Dr Ana Porroche-Escudero (Lancaster University) and Professor Vanessa Speight (Sheffield University) were co-researchers.

Declarations

We have no competing interests to declare. We have no AI or LLM use to declare. The research proposal was reviewed and approved by the Rhodes University Human Ethics Committee (RU-HEC) with approval

number: 2021-2818-6039. Both authors read and approved the final version of the paper.

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