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The Afromontane Research Unit: Driving Connections and Capacity Building for the Sustainable Development of Southern African Mountains



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Research to inform a sustainable future for southern African mountains as social-ecological systems requires major investment. This is needed to strengthen existing relationships, build new relationships among academia, policy, and practice, and drive a robust research capacity program. This is particularly important in disciplines where there is currently limited capacity for mountain-related research in the region. For many pertinent issues in southern African mountains, the urgent need for foundational research is a reality; without this, it is impossible to build toward multidisciplinary outcomes and to drive transdisciplinary efforts. Keys to strengthening solution-oriented research are improved coordination between actors in similar disciplines (eg water security), strong relationships to achieve maximum synergy instead of competition, and major investment in emerging young researchers. The Afromontane Research Unit is leading the way for southern African mountains.

Relationship building for southern African mountains

The Afromontane Research Unit (ARU; Figure 1) is the flagship research group of the QwaQwa Campus of the University of the Free State (UFS-QQ), South Africa, and a Strategic Research Hub of the UFS (le Roux et al 2018; Clark et al 2019). The rich network of ARU relationships continued to grow in 2020, with broader reach and depth of collaborations domestically, regionally, and internationally.

This is reflected in the quality and quantity of research outputs (Box 1).

The ARU's relatively new relationship with the Mountain Invasion Research Network (MIREN) led to the successful award of our first BiodivERsA project, funded by the European Union Horizon 2020 Framework. The project, "RangeX: Mechanisms underlying the success and impacts on biodiversity and ecosystem functioning of range-expanding species under climate change," focuses on untangling complex ecological factors that are driving range-expanding species in mountains around the world. The ARU is partnered in this project with ETH Zürich, Switzerland (lead partner), Martin Luther University, Halle-Wittenberg, Germany, and the University of Bergen, Norway. The collaboration with MIREN adds further support to the ARU's strong focus on nonnative species in southern African mountains (see Box S1, *Supplemental material*, <https://doi.org/10.1659/MRD-JOURNAL-D-21-00038.1.S1>).

A new relationship with the University of Nanjing, China, and the Smithsonian Institute, United States, led to extensive grass taxonomy fieldwork across the Maloti-Drakensberg in February–March 2020, focusing on the poorly understood alpine zone. Outcomes included the discovery of a new grass species (Sylvester et al 2020), taxonomic revisions of ecologically important *C₃* grass species complexes (notably *Festuca* and *Poa*; Soreng et al 2020; Sylvester et al 2020), new species records and population localities of nonnative grass

FIGURE 1 The Afromontane Research Unit is actively developing relationships and capacity for southern African mountain research. (Source: ARU informational leaflet)



species (Sylvester et al 2021), and quantitative ecological surveys of rangeland conditions in the area. As the Maloti-Drakensberg is a grassland-dominated system, this research helps us to better understand this type of alpine ecological infrastructure and the ways in which it affects and is affected by prevailing social and economic activities in the Maloti-Drakensberg. The project represents a small component of the ARU's mountain biodiversity research activities across southern Africa in 2020 (see Box S2, *Supplemental material*, <https://doi.org/10.1659/MRD-JOURNAL-D-21-00038.1.S1>).

The ARU joined the Maloti-Drakensberg Transfrontier Programme (MDTP) Biodiversity Sub-Committee in 2020, opening opportunities to learn from and contribute to this transboundary forum in a science-policy-practice context. This has led to stronger relationships with Lesotho. In parallel, a relationship is being built between the ARU and the National University of Lesotho. One of the first items introduced by the ARU to the MDTP focused on degradation of the Mont-aux-Sources summit (alpine) area (northern Maloti-Drakensberg). This request was put forward following a qualitative site assessment in July 2020, leading to a book chapter currently in production, and the beginnings of quantitative work to empirically examine the degradation of soils and vegetation. The degradation is driven by seasonal, highly intensive pastoralism by Basotho herders,

representing a complex geopolitical challenge between South Africa and Lesotho, and an example of local community-conservation conflict. An MDTP Task Team has been set up to consider this complex problem. The “Mont-aux-Sources nexus” has been the focus of several research funding proposals by the ARU and various partners, and it is the backbone of a proposed “Mont-aux-Sources long-term social-ecological research site.”

A vital, ongoing relationship is with Golden Gate Highlands National Park (GGHNP), managed by South African National Parks (SANParks). Several projects continued through 2020, including research on mammal cognitive behavior in mountains (which has contributed to a regional paper on the use of camera traps to document southern African biodiversity; Pardo et al 2021); avifaunal soundscapes in montane wetlands (Box S3, *Supplemental material*, <https://doi.org/10.1659/MRD-JOURNAL-D-21-00038.1.S1>); fire behavior and management as an important abiotic component (Adagbasa et al 2020; Adelabu et al 2020; Adepoju et al 2020); and invertebrate diversity (Botham et al 2020; van der Merwe et al 2020). This research relationship with GGHNP carries a strong underlying focus on better understanding grassy mountain systems in southern Africa. These systems support unique assemblages of biodiversity

BOX 1: ARU research growth and impact in 2020

- The ARU is proud of its 10 postgraduate graduations in 2020 (up from 2 in 2019), including 4 doctoral degrees.
- Despite COVID-19, and the challenges of academics migrating to online teaching, there was a stream of 42 papers (27 published/accepted, 1 accredited conference proceedings, and 14 submitted manuscripts)—down by only 5 compared to 2019. Quality remained high, with accepted papers having an average journal impact factor (IF) of 2.298, while 48.1% of papers were accepted by journals with an IF > 2.000. Dr Efosa Adagbasa, a previous ARU PhD candidate, and his supervisors, Professor Sam Adelabu and Dr Tom Okello, coauthored the paper that was accepted by the journal with the highest IF of 7.319 (the second highest in the ARU's publication history). A major output was the ARU flagship book *A Scientific Bibliography of the Drakensberg, Maloti & Adjacent Lowlands* (Moffett 2020; Hill 2021) by Professor Rodney Moffett, an ARU research fellow. The book is the first multidisciplinary synthesis of research outputs in the Maloti–Drakensberg mountains.
- ARU activities were profiled in 24 media articles.
- The ARU's research portfolio grew to ZAR 46 million (around US\$ 3 million) in 2020. Although ZAR 8 million (US\$ 500,000) is still pending from applications, the current research portfolio value is the highest for the ARU to date. It is underpinned by 4 large, multiyear awards: 2 University Staff Doctoral Programs (supported by the South African Department of Higher Education and Training), led by Professor Geoffrey Mukwada and Dr Grey Magaiza, respectively; the Risk and Vulnerability Science Centre (supported by the DSI), with ARU Director Dr Ralph Clark as the interim coordinator; and the Mountain-to-Mountain program (supported by the US government), led by Professor Jesse Lutabingwa (Appalachian State University), Dr Grey Magaiza, and Professor Geoffrey Mukwada.

and livelihoods, but they have particular management and sustainability challenges.

In 2020, the groundwork for the African Mountain Research Foundation (AMRF) was laid, following the International Mountain Conference in Innsbruck (September 2019). The AMRF is a strategic initiative to support the ARU in its regional southern African focus and, particularly, to increase the number of long-term mountain observatories across southern Africa. Together with AMRF Founding Trustee Mr Alex Hickman, in early 2020, ARU Director Dr Ralph Clark presented the ARU's southern African vision for strategic contacts in the UK. This included hosting a tea for members of parliament at Westminster Palace, attending a breakfast hosted by the Environmental Funders Network, and meetings with the Ministry for the Environment, the Department for International Development, the Royal Botanical Gardens Kew, the Royal Geographical Society, and Hugh Broughton Architects (who designed the new British Antarctic Science Base “Halley VI”). A complementary visit by Mr Hickman to the Bvumba

mountains, Zimbabwe, the ARU, and AfriSki in February 2020 laid the foundations for the first 2 AMRF mountain observatories. It also garnered support from AfriSki as a focus area for alpine studies in the Maloti–Drakensberg.

Capacity building for southern African mountain research, and for the ARU's own backyard: the mountain city of Phuthaditjhaba

Two ARU-led University Staff Doctoral Programmes (USDP) are building mountain research capacity for southern Africa by supporting 20 academic staff at UFS-QQ and the University of Venda in their doctorates on mountain-related research topics. The USDP collaboration with the United States (in partnership with Appalachian State University, Colorado State University, and the University of Montana) celebrated its first doctoral graduation in the first quarter of 2021. The USDP collaboration with the United Kingdom (University of the Highlands and Islands) was launched in 2020, with focused support for academics in the humanities, economic, and management sciences. The “Mountain-to-Mountain” program, in partnership with Appalachian State University (including the Centre for Appalachian Studies), was launched in 2020. It will provide capacity development mentoring to female black academics and develop a tutored multidisciplinary master's degree program for the sustainable development of southern African mountains.

The ARU's “backyard” is the city of Phuthaditjhaba, a complex urban/peri-urban area in a former South African “homeland” with seemingly intractable challenges, particularly in terms of governance and service delivery by Maloti-a-Phofung Local Municipality (MAP). In 2020, the South African Department of Science and Innovation (DSI) awarded the ARU multiyear funding under its Global Change portfolio to establish a Risk and Vulnerability Science Centre (RVSC) to focus on the “Sustainable Development of Phuthaditjhaba as an African Mountain City.” Given the need to grow research capacity for understanding this city and its challenges, support for ARU academics and students aligned to this theme was immediate, and, from 2021, 30% of the budget will be used for student scholarships. The RVSC also creates 2 new posts in the ARU (a center manager and an administrator), which will be filled in 2021 and will help to grow the ARU's executive management capacity. Several projects under the RVSC had significant traction in 2020, notably work on extreme weather events in QwaQwa and resilience (led by the Centre for Environmental Management, UFS-Bloemfontein, and supported by the South African Water Research Commission) and ecotoxicological and bacteriological assessment of water resources in MAP, with disturbing results (Mosolloane et al 2019; Moloi et al 2020; Mosolloane 2020). Because unemployment is extremely high in Phuthaditjhaba, the RVSC is also supporting key ARU research projects and relationships focusing on social entrepreneurship, migration, visual culture (Makombe and Nyambi 2020), translocal learning and sustainability (Kudo, Allasiw, et al 2020; Kudo, Omi, et al 2020), and spatiotemporal settlement patterns pre- and posttransition from apartheid (Onaolapo et al 2020) (Box 2).

BOX 2: The challenges facing the ARU's hometown: Phuthaditjhaba (Maloti-a-Phofung Local Municipality)

The city of Phuthaditjhaba—the hometown of the ARU—faces many challenges, notably service delivery (particularly water provision) and unemployment. The ARU's new Risk and Vulnerability Science Centre (RVSC) focuses on the “Sustainable Development of Phuthaditjhaba as an African Mountain City.” The RVSC is in a strong position to support research that focuses on a more resilient future for Phuthaditjhaba.

A key project is “Threats of extreme weather events: improving the resilience of QwaQwa to the multiple risks of climate change,” led by Dr Marinda Avenant of the Centre for Environmental Management (UFS-Bloemfontein). It is primarily supported by the South African Water Research Commission, with partners in the ARU (Dr Patrick Voua Otomo); the Cape Peninsula University of Technology, South Africa; Technical University Dresden, Germany; and the Disaster Management Training and Education Centre for Africa (UFS), South Africa.

A EuropeAid proposal tackling the water provision crisis in Maloti-a-Phofung Local Municipality (“VOICEMAP. Voices of Maloti-a-Phofung: climate, water and resilience”), in collaboration with Dr Alexandra Tomaselli and Ms Jess Delves of the Global Mountain Safeguard Programme (GLOMOS)/Eurac Research (Germany/Italy), was submitted in 2020. This was subsequently reworked into a United Nations Democracy Fund proposal (outcome pending).

Maloti-a-Phofung Local Municipality has unique water-quality challenges. These were highlighted by research focusing on ecotoxicological and bacteriological assessments of water resources by Dr Patrick Voua Otomo's research group. The work showed how these facilities have contributed to the contamination of local water resources by pathogenic bacteria, such as *Escherichia coli*, and inorganic pollutants (Moloi et al 2020; Mosolloane 2020).

A key relationship that is being actively supported by the ARU and the RVSC is that between the ARU (Dr Melissa Hansen) and the University of Tokyo/Akita International University, Japan (Professor Shogo Kudo). In 2020, a joint research team from the Department of Geography (Dr Melissa Hansen) and the Department of Community Development (Dr Grey Magaiza) at UFS-QQ was formed to strengthen the ARU's support for this translocal learning project focusing on social entrepreneurship and sustainable development in QwaQwa (Kudo, Allasiw, et al 2020; Kudo, Omi, et al 2020). This also contributed to the development of the short film *Moments: The World River Story* (<https://www.youtube.com/watch?v=UW3n29t87Sc>).

Perceptions of QwaQwa “as home” were explored by Dr Rodwell Makombe and Dr Oliver Nyambi. They examined how migrants from QwaQwa talk about and reconstruct “home away from home” through images and texts that they share on a popular Facebook page named “QwaQwa Thaba di Mahlwa” (Makombe and Nyambi 2021). Their work unpacks the complex and shifting meanings of home, especially for migrants, who often perceive home through the lenses of nostalgia and/or homesickness. Although QwaQwa is a “remote” area with limited economic opportunities, migrants imagine it as an enclave of natural beauty, a custodian of cultural rituals and practices, a rendezvous for family and friends, and as a place of social harmony.

The future looks bright

Despite the challenges relating to coronavirus disease 2019 (COVID-19), 2020 was the ARU's best year to date, confirming its role as a leader in African mountain research, and as a global player. As the home of mountain studies in southern Africa, the ARU looks forward to the first (truly) Southern African Mountain Conference (SAMC2022; www.samc2022.africa). This will bring together academic, policy, and practitioner players from across southern Africa in March 2022.

ABOUT THE AUTHORS

The authors belong to various academic departments in the University of the Free State (UFS), but they form part of the Research Champion Team of the Afromontane Research Unit (ARU). The ARU is organized as a cross-faculty, interdisciplinary, and multicampus research hub within the UFS.

WEBSITES

Afromontane Research Unit: www.ufs.ac.za/aru/afromontane-research-unit
 ARU 2020 Annual Report—Public Narrative (and other resources): www.researchgate.net/project/Afromontane-Research-Unit-Collective
 Southern African Mountain Conference 2022: <https://www.samc2022.africa/>

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Supplemental material

BOX S1 The ARU contributes to invasive plant species research in southern African mountains.

BOX S2 ARU mountain biodiversity and biogeography research crosses borders in southern Africa.

BOX S3 First multiseason soundscape of a montane wetland in southern Africa.

Found at: <https://doi.org/10.1659/MRD-JOURNAL-D-21-00038.1.S1>