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The Afromontane Research Unit: Reaching for New Heights

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The Afromontane Research Unit (ARU), based at the Qwaqwa Campus of the University of the Free State, South Africa, continues to grow in research strength and reach. While a core focus on the sustainable development of the Maloti–Drakensberg will be perennial, the ARU is leading the way in growing a robust community of practice for transdisciplinary research on southern African mountains. Combined with a vision for strong science, policy, and action, this is being achieved through exponential growth of partnerships—local, regional, and global—to tackle relevant issues, in particular wicked problems that seemingly defy achievement of the sustainable development goals. An important component in growing this community of practice is the development of our staff and students at Qwaqwa: for instance, in 2018–2019, US$ 270,000 was invested in Qwaqwa research projects; simultaneously, US$ 500,000 was actively sourced by Qwaqwa academics to supplement these internal ARU funds. The investment and effort are showing increasing return in terms of personal academic development and increased quality and quantity of research outputs. Given that the ARU is still a young research group (5 years old), this exponential growth is encouraging for both science and mountains in Africa.

Introduction

Mountains in southern Africa, here defined according to Clark et al (2019) as south of the Congo rainforests and Lake Rukwa in Tanzania, generally lack a robust science–policy interface. This is because—compared, for example, with eastern African mountains—they are poorly understood as social–ecological systems (SESs) and consequently underappreciated at the policy level, despite the key public goods and services they provide (Clark et al 2019). Even the 40,000 km^2 Maloti–Drakensberg, while better appreciated at the policy level than many other southern African mountains, lacks a combined focus or vision for its sustainable development, with numerous players acting within institutional, geographic, and disciplinary silos. This vacuum creates a powerful niche for the Afromontane Research Unit (ARU) (Mukwada et al 2016; le Roux et al 2018).

With the Maloti–Drakensberg as its backyard and permanent core focus (Figure 1), the ARU, based at the Qwaqwa Campus of the University of the Free State (UFS), has become a regional player by actively driving the growth of a community of practice for southern African mountains. This is being achieved through continued funding investment by the UFS into the ARU, active growth in collaborations and external funding success, and active staff and student development. Ultimately, the ARU seeks to assist in increasing Southern Hemisphere contributions to a currently Northern Hemisphere–focused mountain research community.

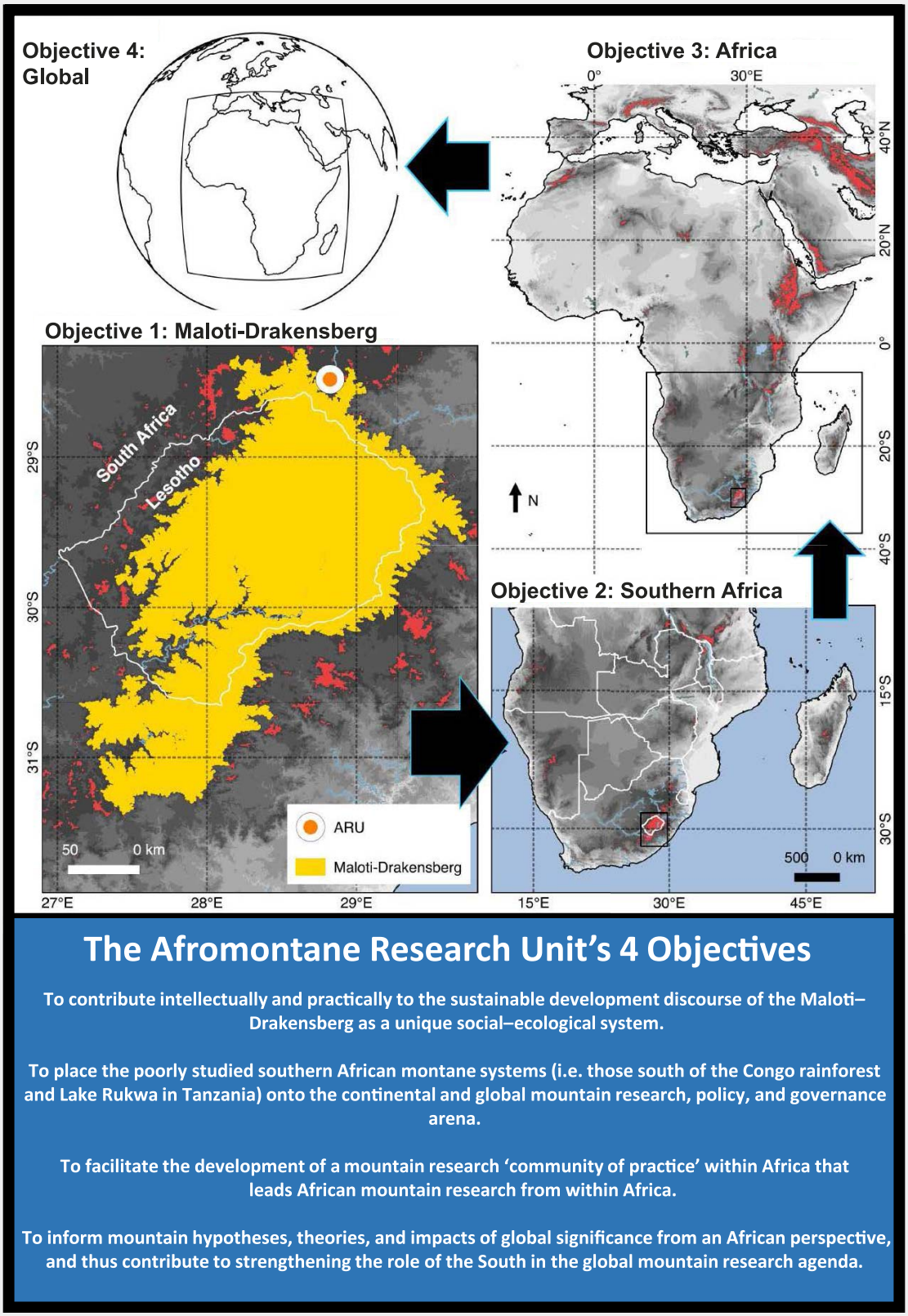
The ARU is growing

Through its cross-faculty, decentralized model, the ARU involves some 25 academic staff in varying capacities, 40 local and international postgraduate students, and 10 postdoctoral fellows of 5 nationalities. The ARU took a leap forward in 2018 through (1) the creation of ARU management positions, and (2) the completion of the ARU building. In terms of management, the first ARU director, Ralph Clark, commenced duties in January 2018; the first ARU student assistant, Albert Malefane, commenced duties in March 2018; the first assistant officer, Lethiwe Sokhela, commenced duties in November 2018; and the first University Staff Doctoral Programme (USDP) assistant, Pulane Xaba, commenced duties in January 2019 (Figure 2). The ARU building was operational as of February 2018.

Building on the ARU's foundation phase (2015–2017), a comprehensive strategic plan was developed in 2018, setting the ARU on a path to becoming a center of excellence (COE) with a focus on southern African mountains as SESs. The vision and mission of the ARU (Box 1) and its 4 key objectives (Figure 1) all speak to this journey toward a COE. Following the first 3-year term, the ARU Advisory Board has been reshaped to create a board that honors existing key relationships, enables future strategic relationships, and aligns with ARU international priorities. Originally confined to Qwaqwa Campus academics, the ARU recently invited association with the ARU from the broader UFS community.

In terms of South African development agendas, the ARU team accords well with transformation policies (UFS 2017), with 70% of the ARU team comprising previously disadvantaged people groups. This is in line with the ARU's third objective: "To facilitate the development of a mountain research 'community of practice' within Africa that leads African mountain research from within Africa."

FIGURE 1 The ARU's 4 objectives (as per the ARU Strategic Plan, 2018).



Investment by the UFS into the ARU remains positive, with US$ 270,000 invested in Qwaqwa research projects in 2018–2019, including student bursaries. Simultaneously, US$ 500,000 has actively been sourced by Qwaqwa academics in the same period to supplement these internal ARU funds. This investment, including that made by the UFS into the ARU since 2015, is showing increasing return in terms of personal academic development and increased quality and quantity of research projects (Box 2) and outputs. For example, research outputs climbed from 8 academic

FIGURE 2 Part of the ARU team in action: (left to right) Dr. V. Ralph Clark (ARU director), Lethiwe Sekhele (ARU assistant officer), Dr. Stefano Tondini (Eurac Research), Pulane Xaba (USDP administrator), Dr. Ahmed Abdelmoneim (ARU postdoctoral fellow), and Prof. Geofrey Mukwada (USDP project manager). (Photo by Ralph Clark; The Amphitheater, Royal Natal Section of the uKhahlamba–Drakensberg Park and UNESCO World Heritage Site)

publications in 2017 to 31 publications in 2018, with at least 3 publications in impact factor 5+ journals in 2018–2019. With 5 completed projects—seeing 2 doctoral, 6 masters, and 9 honors students graduate since 2015—the ARU has to date contributed to 4.25% of postgraduate graduations at the Qwaqwa Campus (UFS 2019).

Regional and global partnerships

Achieving a robust science–policy–action agenda for southern African mountains is not possible alone, within one institution. With the advent of the global village and a welcoming, interactive global mountain research community, the ARU is taking the lead in southern Africa in building partnerships to achieve that vision. For the Maloti–Drakensberg specifically, the ARU has developed mutually beneficial relationships with numerous key partners, including the South African Environmental Observation Network (SAEON), Centre for Biological Control (managed from Rhodes University), Centre for Invasion Biology (Stellenbosch University), the Maloti–Drakensberg Transfrontier Programme, the Grassland Society of Southern Africa (GSSA), South African National Parks, Ezemvelo KZN Wildlife, the Tsitsa Project (managed from Rhodes University), BirdLife South Africa, the National University of Lesotho, and the Universities of Johannesburg, KwaZulu-Natal, Pretoria, and Witwatersrand. In addition to academic partners, the ARU seeks to grow industry (nonacademic and nongovernment) partners, the first being Witsieshoek Mountain Lodge, our portal to the high Drakensberg close to campus.

The ARU has a strong local presence in the community, with numerous research projects embedded in the immediate Qwaqwa region (Box 2); in addition, the ARU seeks to partner with both traditional and elected governance systems in the SES discourse: representatives of both these government structures sit on the ARU Advisory Board and Committee.

BOX 1: ARU's vision and mission (as per the ARU Strategic Plan)

The ARU's vision is to become a continental leader in African mountain research, with an immediate focus on the sustainable development of the Maloti–Drakensberg.

The ARU's mission is to facilitate the development and capacity building of an African-based mountain research community of practice of high excellence that informs global mountain research theory and practice and contributes to mountain-related policy and governance from an African perspective, thus balancing a predominance of mountain research driven from the Global North and Northern Hemisphere.

Relationships for southern African mountains has grown, and includes the Manica Highlands Initiative (Zimbabwe and Mozambique) and the University of Venda (South Africa). International partnerships have grown tremendously since 2018, with some 20 international visitors to the ARU in 2019 alone. Appalachian State University (notably the Centre for Appalachian Studies) and Montana and Colorado State Universities are partnering with the ARU in assisting 6 of our academic staff in achieving their doctorates; this project is being led by Prof. Geofrey Mukwada, one of the founding academics of the ARU. The ARU has a vital relationship with the United Nations University, especially the Institutes for Sustainability & Peace and Environment & Human Security (UNU-EHS). In partnership with Eurac Research, UNU-EHS has formed the Global Mountain Safeguard program, of which the ARU is the primary African partner; this partnership seeks to have a regional influence for southern African mountains. Newer relationships include the University of the Highlands & Islands (UHI), especially the Centre for Mountain Studies, and the Israel Institute of Technology. The ARU is also strengthening connections with and contributions to the other global groups, including the Mountain Research Initiative, the Global Mountain Biodiversity Assessment, and the Mountain Invasion Research Network.

The future

The ARU is awaiting to hear the results of several large applications submitted in 2019:

1. Our first research chair application, submitted to the National Research Foundation (NRF) in July 2019. If the chair candidate is successful, this would be a 5-year chair (renewable), shared between the ARU and the SAEON. Focusing on communal rangeland dynamics and the wicked problem of communal rangeland degradation and mitigation in the Maloti–Drakensberg, this would be our first truly transdisciplinary program.
2. A second USDP application, submitted as a consortium of the UFS, University of Venda, and UHI, is pending consideration by the Department of Higher Education and Training (DHET) and the British Council.
3. The outcome of a Southern African Science Service Centre for Climate and Land Management submission, as

BOX 2: A selection of trending ARU projects, showing the diversity of topics, 2018–2019

- **Community–conservation conflict:** Communities surrounding protected areas play a crucial role in the protection and prolonged existence of these areas. This project examines the conservation conflicts and climate change nexus relating to a rural community in Qwaqwa. *Principal investigator: Ntebohiseng Sekhele (Department of Geography)*
- **Pesticidal metabolites:** Local farmers often use homemade pesticides mixtures from indigenous plants. This projects seeks to understand the chemical basis of the pesticidal metabolites in these plants, with eventual potential commercialization. *Principal investigator: Dr. Mpondi Molefe (Department of Chemistry)*
- **The uniqueness of families in mountain communities:** This project seeks to determine family experiences in the rural mountain area of Maluti-A-Phofung Municipality, Free State. This will inform educators, mental health professionals, and other family-service providers of the unique challenges of families in the area and how these challenges affect family processes. *Principal investigator: Dr. Diana Breshears (Department of Sociology)*
- **Mountain soil and habitat health:** Terrestrial and soil macrofauna are potential indicators of disturbances such as overgrazing, fire frequency, and soil erosion. This project tests these ideas within the Golden Gate Highlands National Park. *Principal investigator: Dr. Emile Bredenhand (Department of Zoology & Entomology)*
- **Education for mountain communities:** Parents living in southern African mountains often have low levels of education because of the rural context. This project seeks to create culturally and contextually responsive education for such communities. *Principal investigator: Dr. Cias Tsotsetsi (School of Education Studies)*
- **Wetland wonders:** Montane wetlands in southern Africa are not well known in terms of faunal composition. Yet some of the most endangered mountain animal species occur in this habitat. This project seeks to determine the bird composition in the 200-ha Qwaqwa Wetland in Golden Gate Highlands National Park—a poorly studied system with the chance of revealing hitherto-unknown populations of rare species. *Principal investigator: Dr. Ralph Clark (Department of Geography)*
- **Prospecting paleoresources in African mountains:** Paleontological fieldwork is time consuming and costly and has a high error rate. Monitoring paleoresources is a necessity for national parks and other conservation organizations but suffers from these same limitations. The increasing availability of high-quality digital data (eg, high-fidelity digital images) from remotely piloted aircraft systems has the potential to increase the efficiency and decrease the cost of paleontological fieldwork and heritage management. *Principal investigator: Gavin Dollman (Department of Computer Science)*
- **High-elevation invasive species:** Nonnative, invasive species are among the main threats to ecosystem service provision in southern African mountains—among the most invaded mountains in the world. Understanding the reproductive ecology of these species is essential to the development of effective management policies to curb these species. *Principal investigator: Dr. Sandy-Lynn Steenhuisen (Department of Plant Sciences)*

Note: Because of space limitations, this is not an exhaustive list; the various non-ARU funders are acknowledged in detail in each project's outputs.

part of a UNU-EHS–led consortium, is anticipated later this year.

4. As chair of the scientific committee of the GSSA, the ARU director will be leading an interdisciplinary call as guest editor for the *Journal of African Rangeland & Forage Science* on montane rangelands (open early 2020 and published early 2021).

FIGURE 3 The ARU welcomes collaborations and partnerships to study southern African mountains as social–ecological systems and to achieve a science–policy–action interface for their sustainable development. (Photo by Ralph Clark; The Camel, ~2800 m, Cathedral Peak Area, uKhahlamba–Drakensberg Park and UNESCO World Heritage Site)

The ARU welcomes collaborations from across southern Africa, the Africa continent, and globally that align with our vision and mission and seek to partner with us to achieve our objectives for a sustainable future for southern African mountains (Figure 3).

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