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Brian John Huntley

Strategic Opportunism: What Works in Africa

Twelve Fundamentals for Conservation Success

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Twelve Fundamentals for Conservation Success

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Preface

The reviews and narratives presented here were triggered by discussions during a retreat for writers, poets and artists at Oak Spring Garden Foundation, Virginia, USA, in the northern autumn of 2019. Our visit coincided with the shock report that since 1970, North America had lost 2.9 billion birds, 30% of its total population (Rosenberg et al. 2019 *Science* 366:120–124). During an introductory session, the focus of one presentation struck a chord – the relatively new concept of environmental melancholia. Environmental melancholia is a condition resulting from environmentally induced stress and depression. The ailment is experienced consciously or subliminally by individuals or communities as a consequence of growing exposure to the loss of a 'sense of place'. It is associated with one's helplessness at the seemingly irreversible degradation of landscapes, the scope and scale of species extinctions and the prospect of the negative impacts of global climate change.

The malady is all too familiar to African conservationists, faced with the collapse of elephant, rhino and abalone populations and their habitats through the industrial scale of the illegal trade in wildlife products. The loss of hope among some conservation professionals is understandable, especially for those on the frontline of anti-poaching actions, or working within weak governments which fail to recognise and address environmental crises.

So how does one respond to the seemingly endless flow of bad news? A positive and pragmatic answer is to focus on successful models that have worked in often difficult situations, which despite enormous challenges, have resulted in sustained success over long periods of time. I therefore sought lessons learned from colleagues across southern Africa, conservationists with 'glass half-full' attitudes, rather than the defeatist 'glass half-empty' perspective that one is often tempted to adopt. I identified projects that fitted the criteria of ambitious but realistic goals and with proven long-term sustainability, and at different spatial scales, socio-political circumstances and institutional capacities. Their work forms the substance of these case studies and provides the evidence base of the conclusion reached: conservation success is possible in Africa.

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Acknowledgements

The personal experiences reflected in this book cover over five decades of working in diverse institutions and countries. At all times I have enjoyed the remarkable friendship and stimulation of inspiring people – cattle herdsmen in the hills of Zululand, game rangers in wilds of Angola, academics at prestigious universities, visiting scientists and an ever-supportive family. As must be the case for every student, the writings of the great pioneers of exploration, evolution and ecology formed the foundations of my learning and presented models of passion and dedication – opening the landscapes of the mind.

I must thank our generous hosts at Oak Spring Garden Foundation, Peter and Elinor Crane, for the opportunity to test ideas with a remarkable mix of artists, writers, poets, gardeners and researchers, in the tranquillity and beauty of rural Virginia, USA. Interdisciplinary artist Regan Rosburg introduced me to the fascinating concept of environmental melancholia – *solastalgia* – and how the syndrome is manifesting in urban and rural communities.

At the Research Centre for Biodiversity and Genetic Resources (Association BIOPOLIS/CIBIO), Porto University, Portugal, my colleagues and friends Nuno Ferrand, Pedro Vaz Pinto, Pedro Beja and Martim Melo have offered feedback on the developing narratives, and CIBIO has provided the ongoing institutional support for my research and writing activities.

Fieldwork in Angola was stimulated by the enthusiasm and good humour of Fernando Costa, Vladimir Russo, João Traguedo and João Serôdio D'Almeida. Marc Stalmans, Ken Tinley, Paul Dutton and Vasco Galante kept me abreast of the Gorongosa Project; Domitilla Raimondo, James Harrison and Alan Lee provided updates on the citizen science projects; Christopher Willis, Gideon Smith, Eimear Nic Lughadha and David Cantrill added details on SABONET, the African Plants Initiative and the extension of activities beyond Africa. The indefatigable team of Marion Island scientists – Marthán Bester, John Cooper, Rudi van Aarde and Ben Dilley – shared their personal experiences in the cat and mouse eradication programmes and plans. In Zimbabwe and Namibia, Brian Child, David Cumming, Russell Taylor, Raoul du Toit, Vernon Booth, Margaret Jacobsohn, Brian Jones, Chris Brown, Maxi Louis and John Mendelsohn provided valuable insights and warm hospitality. In my early professional career, I was extremely fortunate to have mentors with the wisdom of Ian Garland, Ken Tinley, Graham Noble and Alan Rodgers. The ever-positive outlook and optimism of John Hanks, Guy Preston and Clem Sunter have kept me focused on solutions rather than on problems.

Throughout my 50-plus years of working across southern Africa, the unfailing encouragement, and critical editorial skills of my wife, Merle, have been the source of continued support and companionship in often challenging environments.

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About the Author

Brian J. Huntley is a conservation scientist with over 50 years of field research and management experience in many African countries. He has initiated and led to successful conclusion several major inter-disciplinary cooperative research and institutional development projects. Following retirement as CEO of the South African National Biodiversity Institute, he has undertaken reviews of conservation projects in several African countries for various international agencies. He has edited or authored twelve books on various aspects of ecology and biodiversity conservation. He is an invited researcher at the Research Centre in Biodiversity and Genetics Resources (CIBIO) at the University of Porto.

List of Acronyms

AETFAT	Association for the Taxonomic Study of the Flora of Tropical Africa
ALA	Atlas of Living Australasia
ANC	African National Congress
API	African Plants Initiative
BGCI	Botanic Gardens Conservation International
BotSoc	Botanical Society of South Africa
CA	Zimbabwean CAMPFIRE Association
CAMPFIRE	Communal Areas Management Programme for Indigenous Resources
CBD	Convention on Biological Diversity
CBNRM	Community-Based Natural Resource Management
CCA	Community Conservation Area
CGG	Community Game Guard
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CREW	Custodians of Rare and Endangered Wildflowers
CIBIO	Centro de Investigação em Biodiversidade e Recursos Genéticos
CSIR	Council for Scientific and Industrial Research
CSP	Cooperative Scientific Programmes
DFID	Department for International Development (UK)
DNC	Department of Nature Conservation (Namibia)
EWT	Endangered Wildlife Trust
GEF	Global Environment Facility
GNP	Gorongosa National Park
GoZ	Government of Zimbabwe
GP	Gorongosa Project
GPI	Global Plants Initiative
GRP	Gorongosa Restoration Project
GSPC	Global Strategy for Plant Conservation
GTZ	German Agency for International Cooperation
IBP	International Biological Programme

ICSU	International Council of Scientific Unions
IFP	Inkatha Freedom Party
IRDNC	Integrated Rural Development and Nature Conservation
IUBS	International Union for Biological Sciences
IUCN	International Union for the Conservation of Nature and Natural Resources
LAPI	Latin American Plants Initiative
MET	Ministry of Environment and Tourism (Namibia)
MPA	Marine Protected Area
MSB	Millennium Seed Bank
NACSO	Namibian Association of CBNRM Support Organisations
NBI	National Botanical Institute
NESAPS	Network of Southern African Plant Scientists
NETCAB	USAID Regional Capacity Building Network for Southern Africa
NWT	Namibia Wildlife Trust
PAC	Pan Africanist Party
PRECIS	Pretoria (PRE) Computerised Information System
ProDoc	Project Document
RDB	Red Data Book
ROSA	IUCN Regional Office for Southern Africa
SABAP	Southern African Bird Atlas Project
SABONET	Southern African Botanical Diversity Network
SACP	South African Communist Party
SANAP	South African National Antarctic Programme
SANBI	South African National Biodiversity Institute
SASCAR	South African Scientific Committee on Antarctic Research
SASUSG	Southern African Sustainable Use Specialist Group
SCOPE	Scientific Committee on Problems of the Environment
SSC	Species Survival Commission
SVC	Save Valley Conservancy
SWAPO	South West African Peoples Organisation
UCT	University of Cape Town
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
USAID	United States Agency for International Development
WCPA	World Commission on Protected Areas
WWF	World Wide Fund for Nature

Part I
Background

Chapter 1
Strategic Opportunism: A Pragmatic Approach to Conservation in Africa

> *You can form all the committees, all the societies, all the working groups, all the charities you like but you know that in the end, it is that one individual, that one individual that has passion, that one individual that has fire in the belly, that one individual that is determined that something should be done.*
>
> *Sir David Attenborough: Extract from address at the Future for Nature Awards Ceremony, Arnhem, The Netherlands, 2009*

In the three decades since the United Nations Convention on Environment and Development convened in Rio de Janeiro, 1992, many billions of dollars have been invested in time-bound projects aimed at solving conservation crises and addressing human wellbeing needs in Africa. Much has been achieved. Yet in many countries the threats to biodiversity and to human development have increased rather than declined. Despite this sobering background, reasons for hope can be found in a selection of highly successful projects that offer models for adoption. Conservation success is possible in Africa.

This book addresses a complex mix of questions that challenge the minds of young conservationists and environmental scientists working in Africa: “How does one succeed in designing, initiating, implementing and leading to successful conclusion conservation projects in countries with weak institutions, unpredictable socio-economic and political trajectories, and limited human and financial capacities?” In search of answers to these questions, this book synthesises the lessons learned from a diversity of projects, across ten countries, each of which has been sustained for two or more decades. Detailed narratives are presented on the key personalities that have conceived, conducted and concluded long-term projects – personal stories of vision, challenges, failure, frustration, passion and persistence ultimately leading to success.

The case studies vary widely in their geography and goals. In selecting models that illustrate fundamental lessons, the three massively funded mega-projects of the region – those of the Peace Parks Foundation, African Parks Foundation, and the Working for Water Project – have been omitted. They have been widely celebrated

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and are well known. Here I have chosen less familiar and more moderately funded projects. Each demonstrate pragmatic solutions to complex problems. The single-handed commitment to re-discover and save the last surviving populations of giant sable in the miombo woodlands of central Angola, through the capture, translocation and establishment of robust breeding herds of this magnificent antelope, contrasts with the robustly funded, three-decade-long programme with over one hundred participants that reversed the annual loss of 455,000 seabirds to predation by feral cats on a sub-Antarctic island. The foresight of Zimbabwean and Namibian ecologists in placing rural communities at the centre of conservation programmes, by giving value to wildlife populations and benefits to local people, transformed a land degradation problem into a socio-ecological solution. Across ten countries, building capacity in botanical collection, documentation and herbarium management expanded into a global project that placed the knowledge base of Africa's flora onto an electronic data system accessible to researchers and conservation planners in even the most remote corners of the continent. None of these projects enjoyed immediate results. Each required remarkable leadership skills that combined vision, a generosity of spirit, fortuitous timing and the exploitation of the unexpected. These characteristics encapsulate the theme of this book: strategic opportunism.

The projects include models from both rich and poor countries, from those with long histories of biodiversity research and wildlife conservation, to those with weaker institutions and difficult histories. Some accounts are comprehensive and based on scores of peer-reviewed publications. Others are more anecdotal and draw on the field experience of key players, on correspondence and on personal interviews.

Focusing on the drivers of project success, twelve guiding lessons emerge from approaches where leaders took the long view on conservation. These fundamentals for success reflect the tools used, knowingly or not, by practitioners. The projects have survived changes in political leadership, economic climate and institutional arrangements, illustrating how success can be achieved regardless of systems of governance, of a nation's wealth, or of cultural traditions.

The case studies all have one characteristic in common – the central role of a champion or of champions driving an idea to success. In sharp contrast to stories of success in the business sector, none of these champions received any financial reward from their innovations and energy. In reality, many suffered years of physical and financial difficulty, in isolation – often with their life partners and families – and often without recognition other than that of their peers. Success resulted from inspiration, passion, innovation, opportunity and determination: Sir David Attenborough's 'fire in the belly'.

Reference

Attenborough D (2009) Keynote speech. Future for Nature Awards, Arnhem

Chapter 2
Seizing the Moment While Imagining the Future

In the extensive international literature on project design and management, a multitude of models have been proposed through which to achieve successful outcomes. Six studies are pertinent to the present review. John Kotter (1996) provides an eight-step process for change, widely applied by the business community and adapted by Brian Child (2019) to community-based conservation projects. Richard Cowling et al. (2002) identify three interdependent components for consideration in structuring biodiversity mainstreaming projects - prerequisites, stimuli and mechanisms. Andrew Balmford (2012) synthesises conservation projects in terrestrial and marine environments and describes ten characteristics fundamental to success. Robert Pringle (2017) proposes eight pillars to be followed in the upgrading and expansion of protected areas. Peter Crane (2022) spelled out the message used in the title to this chapter: 'Seizing the moment while imagining the future' which underpins the concept and practice of strategic opportunism.

The above authors' elegantly simple frameworks, based on case studies from across the globe, identify key elements for success in business management, biodiversity mainstreaming, species and ecosystem conservation, protected area rehabilitation and the development of botanical gardens. Despite the differences of sector activity and the spatial scale of objectives, the driving elements identified have great consistency. Their lessons can be widely applied. Unsurprisingly, despite the efforts of international development agencies over the past half-century, there is no universally adopted formula for success in conservation projects that suggests that 'one size fits all'. Each situation has its individual idiosyncracies, temporal and geographic scales, socio-political and institutional strengths and weaknesses, and financial opportunities and challenges. Here it is proposed that the approach of strategic opportunism is most appropriate to the real-world challenges faced by conservationists in Africa. African solutions to African problems.

So, what is 'strategic opportunism'?

Over the past 50 years, as a researcher, administrator and project participant at various levels in all southern African countries, I have followed an approach that I have somewhat flippantly called 'strategic opportunism'. At the outset, I must

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emphasise that it is not a formalised model such as the 'Theory of Change' process used by many international and non-governmental agencies for project planning. In my personal experience, strategic opportunism emerged while working within fragile socio-ecological landscapes and adapting to uncertainty and change.

The concept and practice of strategic opportunism is not included in academic curricula, nor taught at post-graduate schools of wildlife management. But it requires nothing more than a clear vision, ideally shared by one's colleagues and project partners, within a flexible strategy through which to achieve realistic goals. The unpredictable opportunities that arise with the passage of time are key ingredients for success. While attending to frequent minor crises, one must never lose sight of the long-term vision. It contrasts with the rigid project frameworks demanded by many development agencies, which leave no space for chance or surprise. In reality, opportunities – big or small, arising from serendipity or simple good luck – must be recognised and exploited. In short, it amounts to transforming problems into solutions. Strategic opportunism is most concisely defined in Peter Crane's "seizing the moment while imagining the future". More formally, the concept is defined as "the ability to remain focused on long-term objectives while staying flexible enough to solve day-to-day problems and recognise new opportunities" (Iselberg 1987).

Even more than in politics, conservation is the art of the possible. It is a slow and iterative process. Strategic opportunism follows the West African expression: "softly, softly, catchy monkey". In simple terms, strategic opportunism is a mix of vision + strategy + opportunity + timing = success. It is not a rigidly linear process. The first requirement – a clear and shared vision – is fundamental. The strategy itself might be quite flexible – comprising many tiers of actions that include the ways and means of achieving goals – not tightly structured and time-bound plans.

The case studies that provide the evidence base for this set of hypothetical fundamentals demonstrate the key elements of strategic opportunism. Starting with a shared vision – imagining the future – the process advances through the matching of global ideas to feasible local actions, and through growing networks of collaboration. Mutual trust between partners are essential ingredients. Along the route, young talents must be nurtured. Mistakes will be made, but must be tolerated. Moving from small interventions to grander, bolder actions, a critical mass of committed, passionate partners 'get things done on the ground'. The latter point is most important. Unless measurable impact is achieved 'on the ground', no elegant theories, elaborate policies, acts of parliament or voluminous conference conclusions will guarantee success.

Getting things done on the ground will very often result from unexpected opportunities. Serendipity happens. One must be ready to act in response to chance events – seizing the moment. Each of the case studies illustrates how an unplanned event accelerated progress or changed the trajectory of a project. The surprising detection of hybridisation between giant sable and roan antelope catalysed efforts to capture and translocate genetically pure sable to form a breeding population. A chance meeting between a potential donor and the country's president triggered the Gorongosa Restoration Project. Connecting the dots between a simple digital scanning technology and the need to document hundreds of thousands of herbarium specimens led rapidly to the African Plants Initiative.

Moving from quick wins to broader successes requires the flexibility of the strategic opportunism approach. By giving participants in citizen science projects regular feedback through newsletters and press releases, local but significant findings were celebrated. The early volunteers of the bird atlasing and wildflower conservation projects could never have anticipated the vast impact of their projects, but they imagined a future of an easily accessible database that would guide conservation action.

In contrast to the practice of rigid project structures, not each step of project implementation needs to follow a seemingly logical sequence. Eradicating feral cats on Marion Island built on decades of fundamental research on seabird and cat population biology. The project advanced through trial and error, frequently revising approaches. It was a process of successive approximation – each step getting closer to the goal, through what can best be described as 'learning by doing'. The years of negotiation required to access funding for the SABONET project saw progress in spasms rather than in predictable flows. Projects, like thinking, move both fast and slow.

Finally, an additional ingredient is needed for strategic opportunism to succeed. In all 'communities of practice' – loose networks of collaboration – keystone individuals are essential. Each of the successful projects reviewed had such personalities. These included political leaders with a commitment to the environment and its conservation, respected leaders of rural communities, academics with inspiring ideas and energetic students, private sector investors looking for socially meaningful projects, or amateurs and volunteers forming networks of citizen scientists. These keystone individuals, like the keystone species of ecosystems, served the role of project champions, catalysing symbiotic relationships among all participants. It is these extended families – multi-talented and cooperative 'invisible colleges' – that bring solutions to complex problems in Africa.

References

Balmford A (2012) Wild hope: on the front lines of conservation success. University of Chicago Press, Chicago, 255 pp

Child B (2019) Sustainable governance of wildlife and community-based natural resource management. From economic principles to practical governance. Routledge, London, 382 pp

Cowling RM, Pierce SM, Sandwith T (2002) Conclusions: the fundamentals of mainstreaming biodiversity. In: Pierce SM, Cowling RM, Sandwith T, MacKinnon K (eds) Mainstreaming biodiversity in development. Case studies from South Africa. World Bank, Washington, DC

Crane P (2022) Botanic gardens: seizing the moment while imagining the future. Plants People Planet 4:548–557. https://doi.org/10.1002/ppp3.10306

Iselberg D (1987) The tactics of strategic opportunism. Harv Bus Rev 87(2):92–97

Kotter J (1996) Leading change. Harvard Business School Press, Boston

Pringle RM (2017) Upgrading protected areas to conserve wild biodiversity. Nature 546:91–99

Part ll
Strategic Opportunism in Action: Models of Success

Chapter 3
Angolan Giant Sable: Rediscovery, Rescue and Recovery

> *Just before my trip home at the time [1912], some Angola Boers had managed to get their wagons across the swamps, and had shot a number of the herd for their skins and meat. This was a new treasure trove for them, as they had by then shot out most of the accessible game in Angola … This threatened the complete extinction of the finest antelope in Africa, bearing the most magnificent horns of all.*
>
> Thomas Varian (1953) *Some African Milestones*

3.1 The Rise and Fall of a Narrow Endemic

At the dawn of the new millennium, the national icon of Angola was believed to be extinct. The giant sable antelope (*Hippotragus niger variani*) is a distinctive and geographically isolated sub-species of the widely distributed sable antelope. British railway engineer, Thomas Varian, while surveying a route for the Benguela Railway, discovered the subspecies in the miombo woodlands of central Angola (Fig. 3.1). Having witnessed the ravages of Boer biltong hunters, Varian feared for the future this 'finest antelope in Africa'. He immediately raised the alarm and mobilised the support and legislative intervention of the Portuguese High Commissioner for Angola, General Norton do Matos. Quick action saved the giant sable from the Boer biltong hunters of the 1920s. But half a century later, after decades of relative security, it was a civil war and its aftermath that spelt the giant sable's imminent doom (Walker 2002; Huntley 2017).

In 1971, the giant sable population was estimated to be between 2000 and 2500 animals. The vast majority of these sable occupied the 828,000 ha Luando Strict Nature Reserve, with about 150 in Cangandala National Park, of 63,000 ha, just to the north, across the Luando river (Huntley 1974). The global population was confined to an area of less than 10,000 km^2, with their closest relatives at least 500 km distant in the far corner of the Cuando Cubango (Fig. 3.2). The herds in Luando had been studied by American biologist Richard Estes in 1969/1970 (Estes and Estes

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Fig. 3.1 A giant sable herd in the miombo woodlands of Luando Strict Nature Reserve, 1972

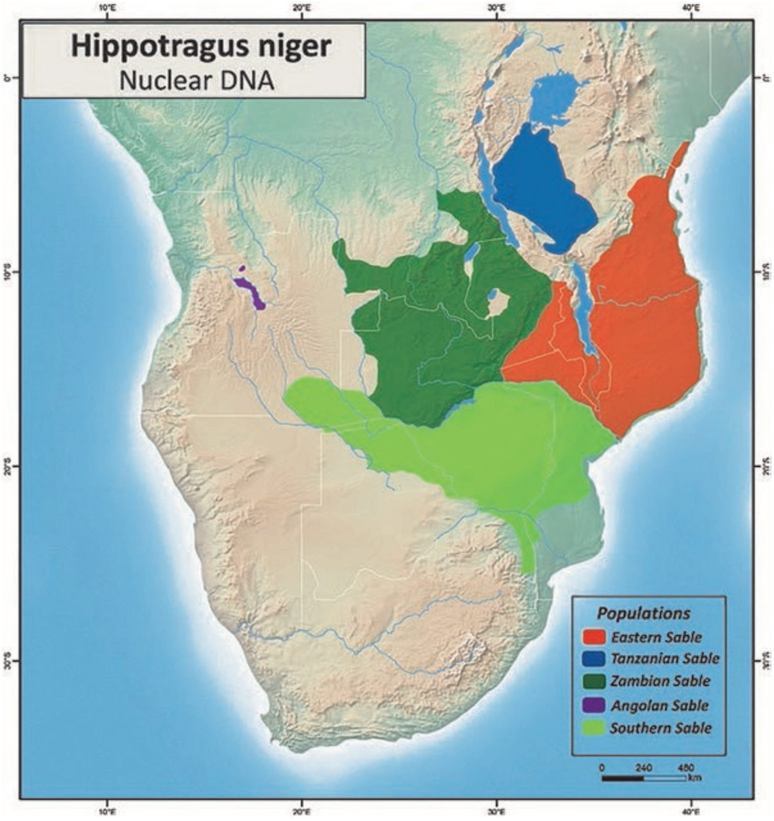

Fig. 3.2 Sable antelope populations (and sub-species) as determined through nuclear DNA analysis. The population of the giant sable of Angola is striking in its isolation. (From Vaz Pinto (2019))

1974). Through the diligent shepherding of the study herds by park warden José Alves, the animals had become so habituated to vehicles that in 1971 one had to hoot at the resting herds to be able to drive though their territory (Huntley 1973, 2017). Little surprise then, that when civil war broke out in the mid-1970s, the giant sable provided easy prey to hunters (Huntley 1975). Dick Estes and park warden João Amaro had photographed a herd in Cangandala during a brief visit in 1982 (Estes 1983), but since that date no sighting of giant sable had been reported. By the end of the twentieth century it was feared that they were already extinct.

International concern for the fate of the giant sable gained traction, especially with the publication of news reports of their possible demise. One book placed the giant sable on the conservation centre stage. The history of the discovery of the giant sable by Varian (1909) and the subsequent pursuit of trophies of the magnificent antelope by some of the world's leading museums and aristocrat hunters, was related in fascinating and compelling detail by John Frederick Walker in his book *A Certain Curve of Horn*. Walker (2002) describes eight frustrating and unsuccessful visits to Angola in search of the sable. He finally saw his first specimen in 2009 - exactly a century after Varian's 1909 report on the giant sable. Walker had joined the capture and translocation project led by an Angolan biologist, Pedro Vaz Pinto. It was the passion, tenacity and commitment of this one person – Pedro Vaz Pinto – that reversed the almost inevitably sad fate of the giant sable, in one of the great modern conservation successes of southern Africa.

3.2 Pursuit and Re-discovery

Much has changed for the better in Angola since the 1990s and early 2000s of Walker's failed pursuits. For the privileged few who today can visit Cangandala and observe the healthy breeding herds grazing quietly in the park's peaceful miombo woodlands, it is difficult to imagine the challenges that Vaz Pinto faced when he decided, in early 2003, to focus his energy on re-discovering the giant sable. Vaz Pinto made repeated visits to Cangandala, first for lengthy surveys on foot across the park with local rangers, covering hundreds of kilometres through the tall miombo woodlands and grasslands Figs. 3.3 and 3.4).

Lest one think that Vaz Pinto's visits to Cangandala were quick rides out from the laboratory into the field, one needs to know that each visit involved a 10-hour drive along some of the worst, and most dangerous, roads in Angola. In the 1970s, the drive from Luanda to Malange would take me a pleasant 6 hours. But for the first decade after the year 2000, the Chinese were rebuilding and once again rebuilding the Malange road, the second busiest highway in Angola. Chinese civil engineers are not the best, and had obviously never encountered the notoriously mobile swelling and shrinking *terras negras de Catete* – the black cotton soils along the first 100 km of the route. The *terras negras* beat the lot of them. The road from Malange to Cangandala village, was worse. The once smooth tar macadam, had fallen apart,

Fig. 3.3 The preferred habitat of giant sable – a mosaic of woodlands and open grasslands: Cangandala National Park. (Photo: Pedro Vaz Pinto)

Fig. 3.4 Open miombo woodland with a dense grass ground cover in Cangandala National Park. (Photo: Pedro Vaz Pinto)

shredding the tyres of any over-hasty driver. So Pedro's repeated visits to Cangandala were never a stroll in the park.

Failure to locate the sable visually persuaded Vaz Pinto to set up camera traps. Selecting a few salt licks – the old termitaria that form nutrient pools in the otherwise poor soils of the *miombo* – he set up three cameras. A month later, in pouring rain and struggling across the flooded rivers near Bola Cachasse, he returned to check the cameras. True to the perverse nature of working in the Angolan bush, only one had functioned. Ants had made nests in the transmitter of one camera, the other had a malfunctioning receiver. When he developed the films, all he found in the images were a few duiker and warthog. He then set up five cameras, and was back again 2 weeks later. This time the problems included termites – so he blocked the tiny holes in the equipment with chewing gum. On the next visit, he found that the camera beam was at too low an angle – so he adjusted the fitting. By the next visit grass and shrubs had grown up in front of the camera – so he chopped the lot down. When he sent the film off to Portugal the results presented four duiker, 13 bushbuck. One had to admire his tenacity. On 14 December 2004 he wrote that one of his trap camera's infrared receivers had malfunctioned, recording 1900 events; another had battery problems. His e-mail read: "This is a game of patience. This activity has been physically and psychologically very demanding and it is frustrating not seeing the animals in so many visits and so many hours spent in the bush tracking them, but every time, finding fresh spoor and dung gives me the extra energy to keep going!"

Even low-level flights in a micro-light plane - including a crash which, in the words of a fellow biologist, left him 'shaken, not stirred'– failed to yield a single sighting. Turning to molecular approaches, Vaz Pinto collected dung and hair samples snagged on bushes for genetic analysis. This initially gave unconvincing results. Two years of continuous but fruitless efforts, and then success.

In February 2005 Vaz Pinto's camera traps revealed a group of female giant sable at a salt lick. Over the next 18 months, he made a further 15 visits to Cangandala, and through hundreds of camera trap photographs he built up an identity profile for 23 individuals. But he had still not seen a single sable with the naked eye. Nor were any male sable to be seen in the camera trap photos. Strangely, some of the female and young sable in the photos had what Vaz Pinto considered a 'funny' appearance. It was suggested by one of Vaz Pinto's volunteers that these animals could perhaps be hybrids. In January 2006 he succeeded in tracking down the herd on foot, and could photograph the group. These were the first sable that he had been able to see live, unaided by trap cameras. But to his great alarm, he noted that although no adult male sable accompanied the herd, a single roan antelope bull had joined the herd. Here Vaz Pinto had the evidence needed to explain the 'funny' members of the herd. These were unmistakably hybrids – 'robles' – the progeny of a lone roan bull and the giant sable cows, bereft of the services of a giant sable bull. The shocking truth was that the giant sable population in Cangandala was facing extinction, not only from poaching, but also from hybridisation (Vaz Pinto 2007; Vaz Pinto et al. 2016). Immediate action was needed.

3.3 Capture and Relocation

With donor support, a 400-hectare quarantine area was fenced off. After protracted negotiations with government agencies, donors and an ever-growing team of volunteers, Vaz Pinto was in position to mount an operation to capture pure giant sable females and to place them in an area isolated from the roan antelope bull. At the same time, a giant sable male in Luando would be captured and translocated to the Cangandala group of pure females. By August 2009 the plans were in place. With the help of the Angolan Air Force, and veteran game capture expert Piet Morkel and helicopter pilot Barney O'Hara, the project began. The nine surviving 'pure' females within Cangandala and a mature male from Luando were captured and translocated to the quarantine area. (Fig. 3.5). Ten other sable were fitted with collars and VHF transmitters. In 2011 two satellite transmitters were fitted to two sable released in Luando. In July 2022, 15 satellite collars were fitted to 10 sable cows and 5 sable bulls, providing an invaluable data set on sable movements, their social behaviour, and to track any incidents of poaching.

In the decade since the first capture success, the quarantine camp has been expanded to over 4300 ha and the captive breeding population has grown to over 100 animals. Despite ongoing poaching, regular satellite monitoring and ground patrols have brought a measure of protection to the Luando population, now estimated at over 200 animals. The combination of intense but arduous field work by one observer over nearly two decades (Vaz Pinto 2018), backed by molecular

Fig. 3.5 Pedro Vaz Pinto with the first giant sable immobilised in Luando Strict Nature Reserve for translocation to Cangandala National Park, August 2012. (Photo: Harold Roberts)

studies on the genetic diversity of sable antelope over their full range across Africa (Vaz Pinto et al. 2015), has added considerably to our understanding of the ecology, behaviour and evolution of this magnificent antelope.

While it might still be too early to celebrate total success in the rescue of giant sable from near extinction, the calamitous decline in the population has not only been halted, but has been effectively reversed. After decades of disinterested rule by the José Eduardo dos Santos regime, the giant sable is now enjoying active government support. Since 2017, the new President of the Republic, João Manuel Gonçalves Lourenço has transformed not only the country's future, but also that of the national icon. The president has appointed a high-level commission to ensure continued support for the project, and a new Minister of Environment is lending support for the provision of facilities and training for the ranger staff at Cangandala. Luando remains without basic facilities and receives only limited government support, but reserve management plans are being developed.

What is not obvious, however, is the fragility of the entire rescue programme. It has been held together by a single passionate volunteer, with uncertain funding, government interference in his initial activities, the continued use of wire-noose and AK rifle poaching of the vulnerable herds at isolated waterholes, and erratic payment of salaries and servicing of facilities for the small corps of rangers. On the positive side, Pedro Vaz Pinto has enjoyed excellent support from the Angolan Air Force, from successive provincial governors, from the local community and from dozens of committed volunteers. By training and inspiring a small team of 'sable shepherds' from the first days of the project, Vaz Pinto has attracted the trust and loyalty of the local community, gaining their support as the eyes, ears and actors in the conservation campaign.

3.4 Lessons Learned

The success of the project can be attributed to multiple factors:

- The existence of international concern regarding the fate of an iconic species.
- The presence of a young, energetic, resilient, charismatic and totally committed conservation biologist who independently and without any secure institutional base, took on the challenge to save the giant sable.
- A highly responsive, adaptive, and opportunistic project management model that allowed rapid maneuverability under complex and ever-changing situations.
- A sustained two-decade long focus for two decades on the key objective of saving the giant sable from extinction.
- The development of a wide base of volunteer and donor support within Angola which shared a long-term vision.
- The availability of highly skilled and experienced technical support from within the region (Botswana, South Africa, Namibia, Zimbabwe) for the capture and safe translocation of many dozens of animals without a single loss of life.

- The foresight on the part of the project leader to gain the trust and active participation of the local human population that shares the giant sable's habitat and restricted geographic range.

The Giant Sable Project demonstrates the concept of strategic opportunism. In its simplicity, focus and the tenacity and adaptability of its leader, it is a model of what can work in Africa.

References

Estes RD (1983) Sable by moonlight. Anim Kingd 1983:10–16
Estes RD, Estes RK (1974) The biology and conservation of the giant sable antelope, *Hippotragus niger variani* Thomas, 1916. Proc Acad Natl Sci Phila 126:73–104. https://www.jstor.org/stable/4064732
Huntley BJ (1973) Luando: home of the giant sable. Afr Wildl 27(4):170–175
Huntley BJ (1974) Outlines of wildlife conservation in Angola. J South Afr Wildl Manag Assoc 4:157–166
Huntley BJ (1975) Angola: a situation report. Afr Wildl 30:10–14
Huntley BJ (2017) Wildlife at war in Angola. The rise and fall of an African Eden. Protea Book House, Pretoria, 432 pp
Varian, HF (1909) The west coast duiker. The Field 113 (March 20, 1909)
Varian HF (1953) Some African milestones. Books of Rhodesia, Bulawayo, p 272
Vaz Pinto P (2007) Hybridization in giant sable. A conservation crisis in a critically endangered Angolan icon. IUCN/SSC Antelope Specialist Group. Gnusletter 26:47–58
Vaz Pinto P (2018) Evolution history of the critically endangered giant sable antelope (*Hippotragus niger variani*) – insights into its phylogeography, population genetics, demography and conservation. PhD thesis. University of Porto, Porto
Vaz Pinto P (2019) The giant sable antelope: Angola's national icon. In: Huntley BJ, Russo V, Lages F, Ferrand N (eds) Biodiversity of Angola. Science & Conservation: a Modern Synthesis. Springer Nature, Cham. Open Access, pp 471–491. https://doi.org/10.1007/978-3-030-03083-4_17
Vaz Pinto P, Lopes S, Mourão S et al (2015) First estimates of genetic diversity for the highly endangered giant sable antelope using a set of 57 microsatellites. Eur J Wildl Res 61(2):313–317
Vaz Pinto P, Beja P, Ferrand N et al (2016) Hybridization following population collapse in a critically endangered antelope. Sci Rep 6:18788
Walker JF (2002) A certain curve of horn: the hundred-year quest for the giant sable antelope of Angola. Atlantic Monthly Press, New York, 477 pp

Chapter 4
Marion Island: Birds, Cats, Mice and Men

It appears to me that nothing can be more improving to a young naturalist than a journey in distant countries … the effect ought to be to teach him good-humoured patience, freedom from selfishness, the habit of acting for himself, and of making the best of every occurrence.

Charles Darwin (1839): *The Voyage of the Beagle*

4.1 Introduction – Africa's Sub-Antarctic Wilderness

Africa is no longer the Dark Continent – no longer unknown, unexplored and inaccessible. Few places in Africa lie more than a few miles from a road, or a few hour's drive from a village or even an airport. Internet access is increasingly ubiquitous. But there remains an African territory that is still seriously remote, wild and untamed: these are the Prince Edward Islands.

The Prince Edward Islands lie some 2300 km southeast of the southern tip of Africa. Discovered and forgotten in the mid-seventeenth century, re-discovered in the eighteenth century, plundered of their seal populations in the nineteenth century, and annexed by South Africa in the middle of the twentieth century, the islands remain little known beyond their rocky shores in the midst of the cold, wet, and gale-swept 'Roaring Forties' of the Southern Ocean.

The two islands, Marion and Prince Edward, form part of the circumpolar islands of the sub-Antarctic (Fig. 4.1). Despite their inhospitable climate, treacherous bogs, and volcanic and glaciated landscapes, the islands are home to hundreds of thousands of breeding seabirds – penguins, albatrosses, petrels and prions – and tens of thousands of breeding fur seals and elephant seals (Ryan and Bester 2008). Marion, the larger island, of 29,000 ha, rises to 1231 m; Prince Edward, of 4500 ha, to 672 m. With an estimated age of 450,000 years, the islands emerge as volcanic peaks from the ocean depths. Landscapes and vegetation include barren or fern covered lava fields, windswept communities of cushion plants, waterlogged mires and bogs, cliff lined coasts and snow-covered mountain peaks (Figs. 4.2, 4.3, 4.4, and 4.5).

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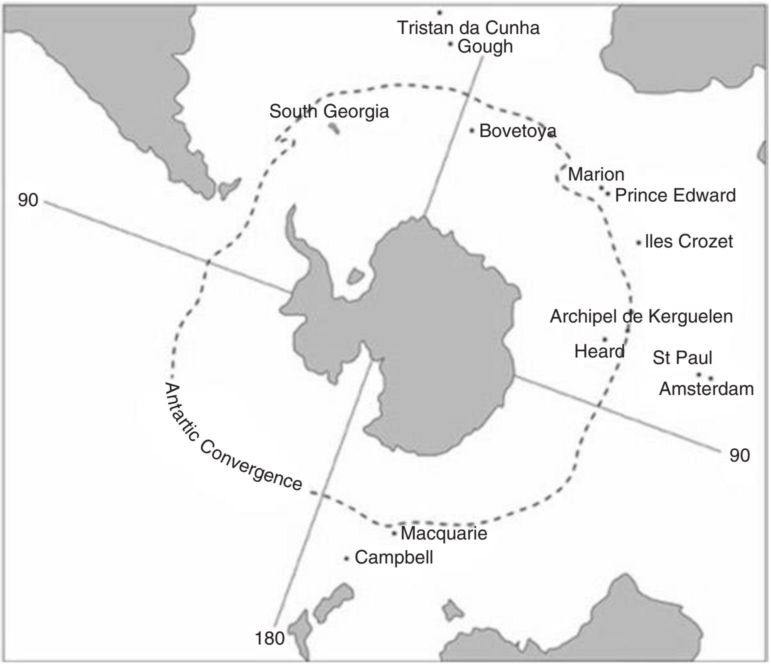

Fig. 4.1 Marion and Prince Edward Islands lie approximately 2300 km southeast of the southern tip of Africa, slightly north of the Antarctic Convergence

Fig. 4.2 Exploring Marion Island in 1965 – the frequently snow-covered central peaks

Fig. 4.3 The fern and shrub-covered basalt lavas of the west coast plain

Fig. 4.4 Black basalt lava flows provide shelter for feral cats

Fig. 4.5 Boulder beaches occupied by breeding colonies of penguins and elephant seals. (Photo: Christiaan Brink)

The islands provide a fascinating story of species-poor, simplified ecological systems at work, and the impact of invasive species on the ecosystem's fragile structure and functioning. They also provide a stage for remarkable actors who have devoted their professional careers to understanding the dynamics of sea-land-plant-animal and human interactions in what, for most researchers, are extremely hostile environments. What makes the islands unique for researchers in the African context is their remoteness, and the challenges that students have to face when physical contact, supplies, medical support, or in earlier years, even communication was a once-in-a-year opportunity.

At the time of annexation in 1947/48, the islands were truly *terrae incognitae*. Only one botanist had previously collected plants on Marion, on a hurried one-day visit during the voyages of the British *Challenger* expedition in 1873 (Moseley 1874). Shortly after annexation, Robert (Bob) Rand spent six summer months (1951/52) on Marion, undertaking a valuable baseline survey of birds and seals (Rand 1954). Like all visitors who followed him, Rand experienced the difficulties of working on the island: "No boat was available on the island; all excursions were made on foot. Food and gear for periods of four to seven days away from the base were carried in a rucksack, including heavy equipment. The varying nature of the ground and the unpleasant climate made movement from place to place very fatiguing, and detracted from the enjoyment and success of biological work. Rain, in particular, was a trying factor …".

As plant ecologist on the first 'Biological-Geological Expedition to the Prince Edward Islands 1965-66' (Van Zinderen Bakker Sr. et al. 1971), I spent 15 months on the islands surveying the flora and vegetation (Huntley 1971, 2016). I could not anticipate the changes that were to follow. In the 1960s, the islands had a mean annual temperature of 5.5 °C, mean annual rainfall of 2726 mm, falling on 311 days per year, and with gale-force winds recorded on 107 days per year.

The climate has ameliorated over the past five decades, with annual precipitation down to.

1778 mm in the 2010s, and temperature means increasing by 1.2 °C, between 1949 and 2016 (Le Le Roux 2008, Le Roux and McGeoch 2008, Hedding and Greve 2018) with a consequent shrinking of much of the icefields of the high plateau (Meiklejohn 2011) and progressive drying of mires and bogs. Climate change has also resulted in multiple ecological changes such as increased house mouse abundance and in turn their impacts on the islands' ecological structure and functioning (Chown and Smith 1993; Smith et al. 2002; Le Roux and McGeoch 2008; McClelland et al. 2018). The history, geology, biology, ecology and conservation of the islands is comprehensively covered in the synthesis volume edited by Chown and Froneman (2008), which draws on the considerable body of publications – over 1000 papers in peer-reviewed journals – of research conducted on the islands since the 1960s.

4.2 An Emerging Invasion Crisis

In common with most island ecosystems (Elton 1958; Mooney and Cleland 2001) but especially those of the remote oceanic islands of the sub-Antarctic, Marion and Prince Edward are highly vulnerable to invasive alien species – the greatest threat to the biodiversity of the sub-Antarctic islands (Frenot et al. 2005; Greve et al. 2017). The first human visitors to the islands were sealers, first recorded in 1802 (Cooper 2008). These early teams of intrepid men unintentionally introduced house mouse *Mus musculus* and several alien plants to the islands, probably from 1818 (Watkins and Cooper 1986). In 1948 five domestic cats *Felis catus* were introduced to Marion Island to try to control the mouse population at the small meteorological station that had been established on the recently annexed island. By 1952, offspring of the original cats had, according to Rand (1954): "gone feral and were preying on the smaller petrels or mice that are widespread over the coastal plain". This is when the trouble really began.

By the time of my survey of the island, in 1965/66, the depredations of the cats on the smaller seabirds and the nightly foraging activities of mice were regularly observed. In hindsight, the 1965/66 Expedition should have raised the alarm regarding the crisis that would develop from cats and mice on the islands, especially given the warning call on the impacts of invasive biota raised a few years earlier by the seminal work of Charles Elton (1958). In their comprehensive review of the feral cat eradication project on Marion Island, Bester et al. (2002) noted that in October

1965, the expedition leader, Van Zinderen Bakker, informed the South African Scientific Committee on Antarctic Research (SASCAR) that: “The feral cat population was not large enough to threaten bird populations, and that the cats were indeed contributing to the control of mice in the meteorological station.” I suspect that Van Zinderen Bakker, a humanist and sensitive animal-lover, felt some compassion for the friendly cats that then lived around the meteorological station.

A decade later, research confirmed that the cats were exerting a negative impact on the bird populations (Anderson and Condy 1974). More dramatically, what focused attention on the ecological crisis on Marion Island was a report by Van Aarde (1975), that an estimated 455,000 birds were being killed annually by the population of feral cats. SASCAR was convinced that a cat eradication programme should be initiated.

What followed was the most ambitious, largest, longest and most expensive cat eradication programme yet undertaken on an island ecosystem. It still remains the most successful operations of its kind (Preston et al. 2019). As a model of the integration of elegant basic research, targeted monitoring and pragmatic conservation action by literally hundreds of contributors, it stands out as a conservation project that brings credit to South Africa. Yet, as noted at the end of this chapter, work on invasive alien mammals on the Prince Edward Islands has not yet concluded.

4.3 A Science-Driven Approach to Eliminating an Aggressive Invasive Species

Following the Van Zinderen Bakker expedition of 1965/66, nearly a decade passed before research resumed on the islands. Three institutions took the lead – the Percy FitzPatrick Institute of African Ornithology at the University of Cape Town, the Mammal Research Institute at the University of Pretoria and the Botany Department at the University of the Free State. The programme was multi-disciplinary, focusing initially on adding fine detail to the broad outlines of the biota reported by the 1965/66 expedition (Van Zinderen Bakker Sr. et al. 1971). By the end of the 1970s, detailed accounts were completed on the vegetation, cats, mice, ground-nesting birds, marine mammals and nutrient cycling in terrestrial ecosystems (see papers in Chown and Froneman 2008). Enough scientific evidence regarding the impact of cats on the burrow-nesting seabirds had been assembled to mobilise the cat-eradication project. Like similar science-driven projects, short funding cycles resulted in a rather unpredictable and frequently interrupted programme of work. But the commitment and persistence of the research leadership, and generous support of the main governmental funding source ensured ultimate success.

As with most large cooperative projects, there were many key players and champions. The stalwarts of the Marion Island research programme over many years include Rudi van Aarde and Marthán Bester (mammalogists), Valdon Smith and Niek Gremmen (botanists), John Cooper and Peter Ryan (ornithologists) and Steven

Chown (entomologist) – plus a talented cast of over one hundred co-workers. Unsurprisingly, in contrast to the vast detail on the natural sciences included in the 1000-plus papers published on the islands' biophysical history, biological diversity and ecological structure and functioning, only a handful of papers cover the human sciences, and even fewer study the social history of the island's transient community of researchers, meteorologists and support teams. Fortunately, this near vacuum has been ameliorated by a fascinating collection of memories of the mammalogists, ornithologists, botanists, entomologists and cat-hunters involved in four decades of the cat eradication programme and of seal studies on the islands (De Bruyn and Oosthuizen 2017). The anecdotes – full of nostalgia of the blood, sweat and tears of working under physically and mentally demanding conditions, and of failures and triumphs have a primary focus – the remarkable leadership and charisma of the person who drove the project to success, Marthán Bester (Fig. 4.6). Here I will draw heavily on Bester et al.'s (2002) summary of the cat eradication programme.

Bester and his co-authors describe the seven phases of the feral-cat eradication programme, sometimes overlapping in chronology, and which extended over 25 years from conception to successful conclusion. Their paper provides an excellent model for such projects, even though the authors cautioned that there were many factors in the exercise that were peculiar to Marion Island, and that the programme: "… may therefore not be repeatable in the same way on other islands." The phases follow a logical succession of a science-based collection of evidence for the development of policy and practice – a pragmatic exercise of 'learning by doing'.

The *first phase* studied the ecology of the feral-cat population. Cat distribution, density, habitat selection, feeding and reproductive behaviour were studied between 1974 and 1976. The thorough research of Rudi van Aarde, published in a series of papers (Van Aarde 1978, 1979, 1980, 1983, 1984; Van Aarde et al. 1996), provided

Fig. 4.6 Marthán Bester with a tame member of the feral cat population. (Photo: Grant Craig)

a firm baseline on the biology and demography of the cat population. His estimates put the 1975 population at 2139 individuals, increasing by 26% per annum, and annually consuming an estimated 455,000 burrowing petrels. A decade later, Schramm (1986) estimated that Marion had suffered a 25-fold decrease in burrowing petrel population densities as compared to those of cat-free Prince Edward Island, 19 km to the northeast of Marion.

Having established the magnitude of the problem, a diversity of solutions was considered by the advisory group established by SASCAR. Biological control was recommended, and here the extended experience of the Veterinary Research Institute at Onderstepoort, Pretoria, provided leadership. The *second phase* researched the feasibility of using feline panleucopaenia virus (a highly contagious parvovirus that causes cat distemper) as a biological control. Serological testing of a small sample group of Marion cats proved the efficacy of the approach (Howell 1976, 1984). However, despite the potency of the virus, it was still considered necessary to have an integrated control programme using a variety of techniques, of which the virus would be a primary component.

Basic research advanced into applied research in the *third phase*, from March 1977, when the cat population was estimated at 3405 individuals. This phase saw the release of 96 cats inoculated with the virus, at 93 sites around the island, using helicopter support. Evaluation followed introduction. *Phase four*, from November 1976 to May 1978 assessed the impact of the virus. It was found that there was an estimated 53% reduction in the cat population after 18 months (Erasmus 1979). It was suspected that the cats could develop resistance to the virus, indicating the need for a multifaceted approach. Phase four explored a variety of other controls. Cage traps and gin traps, plus different baits and lures and a range of poisons were tested. Hunting with shot guns by day and by night was evaluated, as was hunting with dogs – three Jack Russell terriers, a German shepherd and a Labrador.

All these experimental approaches proved too costly or inefficient or held potential environmental risks. Despair started to set in. Bester et al. (2002) recorded that by February 1978 some doubt was expressed that the cats could ever be eradicated. Undaunted, three years after the virus release, SASCAR wisely recommended that further control, monitoring and research were needed.

The *fifth phase*, from April 1981 to May 1983, intensified studies on the impacts of the virus on cat demographics and ecology, their effect on bird populations, and the utility of hunting as a secondary control measure. These detailed studies gave results that confirmed the promise of an integrated approach. The cat population had been decreasing by 26% a year, and by 1982 it was down to 615 individuals or 18% of the 1977 population. But the news was not uniformly positive. By 1983 the cats were found to be developing immunity to the disease (Van Rensburg et al. 1987) and parallel studies concluded that the bird populations were still threatened (Fugler et al. 1987; Newton and Fugler 1989).

With a much-reduced cat population, hunting became a feasible (but very costly) option (Van Rensburg and Bester 1988). *Phase six*, between August 1986 and May 1989, focused on hunting by night using 12-gauge shot guns and battery-operated spotlights (Fig. 4.7). Eight teams of two men killed 458, 206 and 145 cats in the

Fig. 4.7 Teams of hunters used spotlights to locate and shotguns to kill 809 cats during three hunting seasons. (Photo: Kevin Language)

three winter hunting seasons. But the decline in hunting success indicated that hunting alone would not be sufficient. An independent review of the programme was commissioned. The reviewers recommended continued hunting in winter, and that dogs and baits be tested once more, and that controlled gin trapping and poisoning be used. It became obvious that complex problems such as invasive species control need multiple approaches to their solution.

Having already spent many millions of dollars on the programme, the funding source (Ministry of the Environment) needed a compelling motivation to invest more millions. Fortunately, the strong and courageous departmental and institutional leadership was convinced by the quality of the science, the seriousness of the developing conservation crisis, and by the commitment of the researchers, hunters and support teams. Funding was approved for the final, and most expensive, *seventh phase* which commenced in April 1989 and ended in March 1993.

Increased intensities of trapping, hunting and poisoning led to the last cat being trapped in July 1991. Other than a few skeletal remains, no further signs of live cats were found despite even higher intensities of hunting and trapping effort over the following 22 months. During the core control period, from 1986 to 1993, no fewer than 76 hunters were engaged, a total of 14,357 hours of hunting was invested, 3155 cat sightings were made and 768 cats shot. In total, 197 cats were trapped, using 3227 traps and 30,000 poisoned day-old chicken baits. The total count of cats killed (excluding those that died, undetected, from panleucopaenia or poisoning), was 1080 (Bester et al. 2002).

By 2000, with no cats having been seen nor their signs detected in over nine years, it was concluded that cats had been successfully eradicated from Marion Island (Bester et al. 2000). This was unquestionably the largest successful cat eradication programme yet undertaken at the scale of Marion Island's 29,000 ha of unforgiving volcanic mountains in the sub-Antarctic. Nearly three decades passed before another extensive cat eradication project was successfully concluded – on tropical Dirk Hartog Island, of 63,000 ha – just off the West Australian coast (Algar et al. 2019).

4.4 Lessons Learned

Bester et al. (2002) suggested that, with the benefit of hindsight, greater efficacy could have been achieved by a quicker, more intense initial reduction, followed by a large and persistent effort. However, the Marion programme required considerable, lengthy and repeated consultation due to the risks and sensitivities of such a novel project. The media regularly published articles and letters on the project, positive and negative, reasoned and emotional. Further, the inevitable lags associated with mobilising the very considerable finances required for such a large programme on a remote and inhospitable island resulted in its extended timespan. Bester et al. (2002) humbly concluded that: "Few would understand what it takes to be a successful hunter on Marion Island, and particularly what was required to prove the absence of cats over the last 22 months of the programme."

In their assessment of the programme, Bester et al. (2002) noted three critical drivers of success, of which they considered the first the most important:

- The susceptibility of the Marion cat population to the feline panleucopaenia virus;
- The lack of tall stands of vegetation, which would have rendered the hunting campaign impossible due to decreased sighting rates and hunting success; and
- The recolonisation of preferred habitats, cleared of cats, from neighbouring suboptimal habitats, which served continually to concentrate surviving cats in smaller areas.

Other factors contributing to the success of the programme noted by Bester et al. (2002) were:

- The initial study of cat biology and distribution provided detailed knowledge of the cat population;
- The absence of other terrestrial predators which would have interfered with the trapping and poisoning campaigns;
- The inclusion of experienced personnel from previous teams in each new team to continue the programme; and
- The resolve of the funding bodies to provide the necessary support.

What Bester et al. (2002) did not mention, but which were equally important factors included:

- The early recognition by young researchers of the gravity of the impact of the feral cats on the bird population and the urgency to mobilise population control actions;
- The importance of the scientific and technical capacity of South African institutions, in particular the Veterinary Faculty of the University of Pretoria at Onderstepoort, and the Mammal Research Institute, University of Pretoria;
- The high quality of the basic biological studies undertaken by young researchers spending long periods, usually without direct mentorship, on the island;
- The availability of young, resilient, adventurous and extremely dedicated cat hunters, willing to work under extremely difficult weather conditions in hazardous terrain, usually in the pitch darkness of freezingly cold winter nights;
- The strong leadership and intellectual maturity of the projects' young field supervisors; and
- Finally, and most importantly, as repeatedly emphasised in the 464-page tribute volume to Marthán Bester (De Bruyn and Oosthuizen 2017), one fact is abundantly evident: the inspiring leadership of the man. Through the multiple challenges of logistics, personalities, inclement weather, hazardous terrain and financial uncertainties, Bester was able to provide calm, decisive and firm leadership of the 76 cat hunters, dozens of researchers and the inevitable demands of government administrators, advisory committee members and the interested public.

4.5 Postscript: When the Cat's Away, the Mice Can Prey

Eradication of the cat population has not removed the problem of alien predators from Marion Island. As early as 1990s the impact of cat eradication on the house mouse population, and the knock-on effect of higher mouse populations on their invertebrate prey, was discussed by Van Aarde et al. (1996). The island's mice, weighing in at a mere 20 grams, are now proving to be mortal predators on the bird populations, from the smallest burrowing petrels to large fledglings of wandering albatrosses, of up to 7 kilograms.

The task of proving that there are no cats left on the island was a considerable challenge. It took several years of concerted effort by teams of cat hunters spending tedious and often dangerous nights searching the coastal cliffs, soggy mires, rocky plateaus, broken lava flows and desolate mountains of the island. Having concluded that the cats had been successfully eradicated, assessing the recovery of the burrow-nesting seabird populations was the next priority. In 2013, 22 years after the last cat was killed on Marion Island, Ben Dilley re-surveyed the same study sites where petrel burrows had been counted by Michael Schramm in 1979. Schramm revisited Marion with Dilley to ensure replicability of the surveys. In the northeast sector of

Marion Island, 741 quadrats of 10 × 10 m were searched for burrows, following Schramm's design. Based on the known dynamics of burrow-nesting seabird populations on neighbouring Prince Edward Island, free of introduced predators, Dilley et al. (2016a) expected a three- to five-fold increase in Marion petrel burrow densities following cat eradication. However, within the 1041 ha study site, the number of burrows of eight petrel species showed only a 56% increase between 1979 and 2013 – from a 1979 estimate of 156,000 to a 2013 estimate of 243,000 burrows. Dilley et al. (2016a, 2018) concluded that the slow recovery rate of burrows was due to predation of petrel eggs and chicks by the increasing mice population.

It was not long before mice started attacking larger birds. Dilley et al. (2016b) recorded a seemingly sudden eruption of mice attacks on grey-headed, sooty and wandering albatrosses (Fig. 4.8). Following a first record of attacks on wandering albatross chicks in 2003, one-third of sooty albatross fledglings were found 'scalped' at a remote colony on the island's southwest coast in 2009 (Jones and Ryan 2010). An unprecedented increase in the frequency of mouse attacks on grey-headed, sooty and wandering albatross chicks was recorded in 2015 (Dilley et al. 2016b). Filming at night with motion-activated infra-red cameras provided confirmation that the mice attacked the heads of chicks, debilitating the birds, which in some cases were then attacked by giant petrels. The records showed that 11% of 2201 grey-headed and 9% of 1045 sooty albatross chicks were attacked by mice in the autumn of 2015. Most of the chicks died. Even the large chicks of wandering albatross have not escaped the predations of mice. Between 2003 and 2018, 32 wandering albatross chicks have been noted with mice-inflicted wounds, of which 72% died (Dilley et al. 2016b). In 2016, mice attacks on large chicks of three albatross species continued at similar levels to those seen in 2015. In 2017 and 2018 fewer albatross

Fig. 4.8 Two grey-headed albatross chicks with typical 'scalping' wounds due to predation by mice, Marion Island, 2015. (Photo: Ben Dilley)

chicks were attacked, but in 2019 attacks were again frequent and widespread, but the reasons for these annual fluctuations are not clear – what has become clear is the sudden increase of this mouse behavior was not a one-off event in 2015.

Even more alarming were the records, in 2017, of mouse wounds on breeding adult giant petrel on Marion Island and adult Tristan albatross and Atlantic yellow-nosed albatrosses on Gough Island (Jones et al. 2019). The adult birds were not killed by the mouse attacks, but the presence of many chick carcasses in the vicinity pointed to the probable cause. As Jones et al. (2019) observe, mortalities of breeding adults would have far greater impacts on the breeding populations than loss of eggs or chicks. Dilley et al. (2016b) concluded that although mice were not an important food source for cats, feral cats might have influenced mouse demography before the cats were eradicated. As Chown and Smith (1993) and Le Roux and McGeoch (2008) have suggested, a warming climate, together with cat removal, might have resulted in increased mouse densities. These reached up to 237 mice per ha (McClelland 2013). With the approach of winter, and with decreasing invertebrate food populations recorded over the past 40 years, mice might be switching their prey. Rayner et al. (2007) attributed this prey switch process to the 'mesopredator release' effect, whereby mesopredators (mice) increase after the eradication of top predators (cats). Marion Island's bird populations are again threatened by an invasive mammal (McClelland et al. 2018).

The concern regarding mice is not new. As early as 1995, a workshop of Marion Island biologists considered that the eradication of mice from Marion Island would be beneficial for the restoration of the island's ecosystem functioning (Chown and Cooper 1995). The workshop made specific recommendations on research activities needed to precede an eradication programme, including mouse population dynamics and feeding behaviour, and the differentiation between the effects of climate changes and mouse predation on the island biota. A decade and a half later, in a detailed unpublished review, Angel and Cooper (2011) concluded that most of the research proposed by the 1995 workshop had been undertaken, "justifying and providing the information necessary for a feasibility study for the eradication of the species on the island." There have been a series of studies on Marion's house mouse population, at irregular intervals from the late 1970s through to the present (Gleeson 1981; Matthewson et al. 1994; Ferreira et al. 2006; McClelland 2013; McClelland et al. 2018). Much has been learned about the interactions of mice with their physical and biological environments. The annual peak populations of mice have been increasing in response to ameliorating climatic conditions, in turn suppressing native invertebrate biomass (McClelland et al. 2018).

In order to accelerate action, John Cooper, one of the pioneer researchers on the islands' bird populations, encouraged funding from BirdLife South Africa, in partnership with the South African National Antarctic Programme (SANAP) to commission a feasibility study: "to assess whether eradication of the mice is feasible, and to review the constraints and risks to be resolved or mitigated before making such an attempt." The field study was undertaken in April 2015 and the results presented to SANAP later that year. The report (Parkes 2016) concluded that the eradication of mice from Marion Island is definitely possible, mice eradication having been successfully achieved on 62 islands, including sub-Antarctic Macquarie Island, which at 12875 ha is half the area of Marion. The tried and tested approach recommended would use up to four large helicopters to disperse cereal-based pellet baits containing the second-generation anticoagulant toxin brodifacoum. The exercise would need to be completed within a few days and repeated within 10 days. As Parkes (2016) noted: "Eradication is the permanent removal of all individuals from a defined area, Marion Island in this case. It is an all or nothing management goal – one cannot almost eradicate a pest".

What is clear, from the available scientific evidence reviewed by Preston et al. (2019) is that: "Left uncontrolled, it is feared that 18 of the 28 species [of seabirds] breeding on Marion Island may be vulnerable to local extirpation should the mice not be eradicated." The significance of this statement is that it is the consensus of its 31 co-authors, all with extended experience in conservation science, action and administration. The lead author, Guy Preston, as Deputy-Director General of the Department of Environment Affairs, Forestry and Fisheries, in the Ministry of Environment, spear-headed South Africa's massive Working for Water project, which has invested more than US$1000 million in nation-wide invasive species control projects over the past 25 years, the largest conservation programme in Africa. The proposal carries the weight of sound science, decades of experience and strong government endorsement.

The concern for Marion's bird populations is paralleled by a similar crisis on Gough Island, in the South Atlantic, where an international partnership was established to implement a mouse eradication project in 2020, led by the United Kingdom's Royal Society for the Protection of Birds. Gough Island, of just 6500 ha, is one of the world's most important seabird breeding islands, home to an estimated 12 million seabirds of 22 species. Predation by mice, with very heavy mortality rates, has been reported for several of its albatross, petrel and prion species (Dilley et al. 2015). The Gough Island mice eradication project has provided a testing ground for South African teams in preparation for a similar project on Marion Island in the southern autumn of 2025. The South African government has already budgeted the equivalent of US$2.2 million for the project, while BirdLife South Africa is mobilising donors and crowd-funding to provide further support for the project. However, the estimated total budget for the project is over US$20 million, a challenge that will require extraordinary fund-raising strategies.

It took over two decades of heroic efforts by more than 100 scientists and cat hunters to eradicate the cats of Marion Island. It would seem unrealistic to expect that the much more numerous, much better concealed, and much more resilient mice population could be eradicated within a few weeks of helicopter-borne aerial bombing with a shower of toxic bait. But as Nelson Mandela famously said: "It always seems impossible until it is done."

References

Algar D, Johnston M, Tiller C et al (2019) Feral cat eradication on Dirk Hartog Island, Western Australia. Biol Invasions 22:1037–1054. https://doi.org/10.1007/s10530-019-02154-y

Anderson GD, Condy PR (1974) A note on the feral house cat and house mouse on Marion Island. S Afr J Antarct Res 4:58–61

Angel A, Cooper J (2011) A review of the impacts of the house mouse *Mus musculus* on sub-Antarctic Marion Island, Prince Edward islands. Report to the Prince Edward Islands Management Committee, South African National Antarctic Programme. 57 pp.

Bester MN, Bloomer JP, Bartlett PA et al (2000) Final eradication of feral cats from sub-Antarctic Marion Island, southern Indian Ocean. S Afr J Wildl Res 30:53–57

Bester MN, Bloomer JP, Van Aarde RJ et al (2002) A review of the successful eradication of feral cats from sub-Antarctic Marion Island, southern Indian Ocean. S Afr J Wildl Res 32:65–73

Chown SL, Cooper J (1995) The impact of feral house mice at Marion Island and the desirability of eradication: report on a workshop held at the University of Pretoria, 16–17 February 1995. Directorate: Antarctica and Islands, Department of Environmental Affairs and Tourism, Pretoria

Chown SL, Froneman PW (eds) (2008) The Prince Edward Islands: land–sea interactions in a changing ecosystem. Sun Press, Stellenbosch, 450 pp

Chown SL, Smith VR (1993) Climate change and the short term impact of feral house mice at the sub-Antarctic Prince Edward Islands. Oecologia 96:508–516

Cooper J (2008) Human history. In: Chown SN, Froneman PW (eds) The Prince Edward Islands: land–sea interactions in a changing ecosystem. Sun Press, Stellenbosch, pp 331–350

Darwin C (1839) The voyage of the beagle. Wordsworth Editions Ltd, Ware, 480 pp

De Bruyn PJN, Oosthuizen WC (2017) Pain forms the character. Doc Bester, Cat hunters & Sealers. Antarctic Legacy of South Africa, Stellenbosch, 464 pp

Dilley BJ, Davies D, Bond AL et al (2015) Effects of mouse predation on burrowing petrel chicks at Gough Island. Antarct Sci 27:543–553. https://doi.org/10.1017/S0954102015000279

Dilley BJ, Schramm M, Ryan PG (2016a) Modest increases in densities of burrow-nesting petrels following the removal of cats from Marion Island. Polar Biol 40:625–637. https://doi.org/10.1007/s00300-016-1985-z

Dilley BJ, Schoombie S, Schoombie J et al (2016b) 'Scalping' of albatross fledglings by introduced mice spreads rapidly at Marion Island. Antarct Sci 28:73–80. https://doi.org/10.1017/S0954102015000486

Dilley BJ, Schoombie S, Stevens K et al (2018) Mouse predation affects breeding success of burrow-nesting petrels at sub-Antarctic Marion Island. Antarct Sci 30:93–104

Elton CS (1958) The ecology of invasions by animals and plants. Methuen & Co, London, 181 pp

Erasmus BH (1979) Control of the feral cat *Felis catus* (Linnaeus, 1758) population on Marion Island with feline panleucopaenia. M.Sc. thesis, University of Pretoria, Pretoria

Ferreira SM, Van Aarde RJ, Wassenaar TD (2006) Demographic responses of house mice to density and temperature on sub-Antarctic Marion Island. Polar Biol 30:83–94

Frenot Y, Chown SL, Whinam J et al (2005) Biological invasions in the Antarctic: extent, impacts and implications. Biol Rev 80(1):45–72. https://doi.org/10.1017/S1464793104006542

Fugler SR, Hunter S, Newton IP et al (1987) Breeding biology of blue petrels *Halobaena caerulea* at the Prince Edward Islands. Emu 87:103–110

Gleeson JP (1981) Ecology of the house mouse Mus musculus Linnaeus, on Marion Island. Thesis. University of Pretoria, Pretoria, South Africa

Greve M, Mathakutha R, Steyn C (2017) Terrestrial invasions on sub-Antarctic Marion and Prince Edward Islands. Bothalia – Afr Biodivers Conserv 47:2

Hedding DW, Greve M (2018) Decreases in precipitation on sub-Antarctic Marion Island: implications for ecological and geomorphological processes. Weather 73:203–203

Howell PG (1976) Report of a sub-committee appointed to advise on the biological control of the excessive cat population on Marion Island. Unpublished report to the *ad hoc* Task Group on Cats and Mice Extermination on Marion Island

Howell PG (1984) An evaluation of the biological control of feral cat *Felis catus* (Linnaeus, 1758). Acta Zool Fenn 172:111–113

Huntley BJ (1971) Vegetation. In: Van Zinderen Bakker Sr EM, Winterbottom JM, Dyer RA (eds) Marion and Prince Edward Islands report on the South African Biological & Geological Expedition/1965–1966. A.A. Balkema, Cape Town, pp 98–160

Huntley BJ (2016) Exploring a sub-Antarctic wilderness: a personal narrative of the first biological & geological expedition to Marion and Prince Edward Islands 1965/1966. Antarctic Legacy of South Africa, Stellenbosch, 268 pp

Jones MGW, Ryan PG (2010) Evidence of mouse attacks on albatross chicks on sub-Antarctic Marion Island. Antarct Sci 22:39–42

Jones WJ, Risi JC, Cleeland J, Ryan PG (2019) First evidence of mouse attacks on adult albatrosses and petrels breeding on sub-Antarctic Marion and Gough Islands. Polar Biol 42:619–623. https://doi.org/10.1007/s00300-018-02444-6

Le Roux PC (2008) Climate and climate change. In: Chown SL, Froneman PW (eds) The Prince Edward Islands: land–sea interactions in a changing ecosystem. Sun Press, Stellenbosch, pp 39–64

Le Roux PC, McGeoch MA (2008) Changes in climate extremes, variability and signature on sub-Antarctic Marion Island. Clim Chang 86:309–329

Matthewson DC, Van Aarde RJ, Skinner JD (1994) Population biology of house mice (Mus musculus L.) on sub-Antarctic Marion Island. S Afr J Zool 29:99–106

McClelland GT (2013) Ecology of the black-faced sheathbill on Marion Island. Dissertation, Stellenbosch University

McClelland GT, Altwegg R, Aarde RJ et al (2018) Climate change leads to increasing population density and impacts of a key Island invader. Ecol Appl 28:212–224

Meiklejohn KI (2011) Marion Island's disappearing ice cap. In: Zietsmann L (ed) Earth observations on environmental change in South Africa. Sun Press, Stellenbosch, pp 57–62

Mooney HA, Cleland EE (2001) The evolutionary impact of invasive species. Proc Natl Acad Sci USA 98:5446–5451

Moseley HN (1874) On the botany of Marion Island, Kerguelen' land and Yong Island of the heard group. J Linn Soc Bot 14:387–388

Newton IP, Fugler SR (1989) Notes on the winter-breeding greatwinged petrel *Pterodroma macroptera* and grey petrel *Procellaria cinerea* at Marion Island. Cormorant 17:27–34

Parkes J (2016) Eradication of house mice *Mus musculus* from Marion Island: a review of feasibility, constraints and risks. In: Wanless RM (ed) BirdLife South Africa occasional report series no. 1. Johannesburg, South Africa

Preston GR, Dilley BJ, Cooper J et al (2019) South Africa works towards eradicating introduced house mice from sub-Antarctic Marion Island: the largest Island yet attempted for mice. In: Veitch CR, Clout MN, Martin AR et al (eds) Island invasives: scaling up to meet the challenge. IUCN, Gland, pp 40–46. Occasional Paper SSC no. 62

Rand RW (1954) Notes on the birds of Marion Island. Ibis 96:173–206

Rayner MJ, Hauber ME, Imber MJ et al (2007) Spatial heterogeneity of mesopredator release within an oceanic Island system. Proc Natl Acad Sci USA 104:20862–20865

Ryan PG, Bester MN (2008) Pelagic predators. In: Chown SL, Froneman PW (eds) The Prince Edward Islands: Land–Sea interactions in a changing ecosystem. Sun Press, Stellenbosch, pp 121–164

Schramm M (1986) Burrow densities and nest site preferences of petrels Procellariidae at the Prince Edward Islands. Polar Biol 6:63–70

Smith VR, Avenant NL, Chown SL (2002) The diet and impact of house mice on a sub-Antarctic island. Polar Biol 25:703–715

Van Aarde RJ (1975) Progress report on cat research and extermination on Marion Island. Unpublished report, Mammal Research Institute, University of Pretoria, Pretoria
Van Aarde RJ (1978) Reproduction and population ecology in the feral house cat, *Felis catus*, on Marion Island. Carnivore Genet Newsl 3:288–316
Van Aarde RJ (1979) Distribution and density of the feral house cat *Felis catus* on Marion Island. S Afr J Antarct Res 9:14–19
Van Aarde RJ (1980) The diet and feeding behaviour of feral cats, *Felis catus* at Marion Island. S Afr J Wildl Res 10:123–128
Van Aarde RJ (1983) Demographic parameters of the feral cat *Felis catus* population at Marion Island. S Afr J Wildl Res 13:12–16
Van Aarde RJ (1984) Population biology and the control of feral cats on Marion Island. Acta Zool Fenn 172:107–110
Van Aarde R, Ferreira S, Wassenaar T et al (1996) With the cats away the mice may play. S Afr J Sci 92:357–358
Van Rensburg PJJ, Bester MN (1988) The effect of cat *Felis catus* predation on three breeding Procellariidae species on Marion Island. S Afr J Zool 23:301–305
Van Rensburg PJJ, Skinner JD, Van Aarde RJ (1987) Effects of feline panleucopaenia on the population characteristics of feral cats on Marion Island. J Appl Ecol 24:63–73
Van Zinderen Bakker EM Sr, Winterbottom JM, Dyer RA (eds) (1971) Marion and Prince Edward Islands: report on the South African biological and geological expedition, 1965–1966. Balkema, Cape Town, 427 pp
Watkins BP, Cooper J (1986) Introduction, present status and control of alien species at the Prince Edward Islands, sub-Antarctic. S Afr J Antarct Res 16:86–94

Chapter 5
Gorongosa National Park: Wilderness, War and Wildlife Recovery

It is one thing to draw a line around a beautiful natural area, declare it to be a national park, then add the amenities necessary to serve the public. It is entirely another thing, at a higher order of magnitude, to restore a damaged park to its original health and vibrancy.

Edward O. Wilson (2014) *A Window on Eternity. A Biologist's Walk through Gorongosa National Park*

5.1 This Once Was an Eden

To succeed, conservation programmes in Africa must take the long view. Sadly, much of conservation investment in Africa looks for quick-fixes and instant gratification. Donor funding cycles force short three- to five-year timeframes, and co-financing commitments from governments are usually shorter, if they ever materialise. The failure of short-term projects are legion. But Africa is full of surprises – even from one of the poorest countries on the continent, Mozambique.

Fifty-plus years ago – in the autumn of 1969 – my wife and I had the good fortune to spend a week of our honeymoon in Gorongosa National Park, Mozambique, as guests of my colleagues from university days, Ken and Lynne Tinley. Ken was completing a comprehensive survey on the ecology of the entire Gorongosa ecosystem, a classic study that has now – a half-century later – been published (Tinley 2021). During our visit, Ken was focusing his attention on the critical role that Mount Gorongosa plays as the source and driver of the region's ecosystem services – long before the concept became a key component of our understanding of environmental functioning and management. To demonstrate his ideas, we did a stiff one-day hike up the 1800 m mountain. We heard the calls, but did not see, several of the mountain's endemic bird species, and marvelled at the altitudinal zonation of vegetation as we ascended the steep, rain-catching mountain face. From the high peak we had a bird's view of the workings of the vast ecosystem – with Ken describing the intricate meshing of geomorphology, hydrology, habitats and fauna (Figs. 5.1, 5.2, and 5.3).

B. J. Huntley, *Strategic Opportunism: What Works in Africa*, SpringerBriefs in Environmental Science, https://doi.org/10.1007/978-3-031-24880-1_5

Fig. 5.1 Gorongosa National Park. View across the Urema Floodplain, with the Cheringoma Plateau in the far horizon. (Photo: Marc Stalmans)

Fig. 5.2 Gorongosa landscapes: Fever trees line the margin of the Urema Floodplain. (Photo: Marc Stalmans)

Fig. 5.3 Montane forests and grasslands clothe Mount Gorongosa. (Photo: Marc Stalmans)

What we saw from Mount Gorongosa during our May 1969 visit was a uniquely coherent and pristine suite of African ecosystems – rivers and lakes and floodplain grasslands and fringing fever-tree woodlands, dry thickets and forests, extensive acacia and mopane savannas and brachystegia woodlands, and on Mount Gorongosa itself, ancient grasslands interdigitating between Afromontane forests. The wildlife populations, of impala, zebra, wildebeest, sable, waterbuck, oribi, nyala, reedbuck, bushbuck, buffalo, hippo, warthogs, elephant and numerous predators had made Gorongosa a special destination for eco-tourists in the 1960s. What we did not foresee was the coming revolution, in Portugal and across its many colonies, that brought death and destruction to so many and so much. This was another chapter in the sad processes that characterised political transitions to independence across many African countries during the 1960s to 1990s. By the year 2000 the game population of Gorongosa had fallen to less than 15% of that which Tinley had recorded in the 1960s. For many, Gorongosa National Park (GNP) was added to Africa's lengthening list of failed protected areas.

5.2 Serendipity and Good Timing

Gorongosa's sad story of decline took a dramatic turn in the early 2000s. In 2004, Gregory Carr, an American intel entrepreneur, human-rights activist and philanthropist, visited Mozambique. His purpose was to discover whether there was a way in which he could help the country, one of the poorest in Africa. He eventually met with Joaquim Chissano, the then President of Mozambique, and learned of the latter's desire to rehabilitate Gorongosa and other national parks in an effort to attract tourists and thus help revitalise the country's economy. Greg Carr was immediately struck by the possibility of contributing to the dual goals of wildlife conservation and social development that a successful, long-term investment in Gorongosa offered. In 2008, in an innovative and efficient development of partnerships, the government of Mozambique entered into a 20-year agreement with the Gregory C. Carr Foundation for the science-based and people-oriented conservation management of the park – initially known as the Gorongosa Restoration Project (GRP). The agreement has since been extended for another 25 years. The project report for 2021 (Gorongosa Project 2021) describes the remarkable progress made in the decade since the first agreement was signed. The Gorongosa Restoration Project was never meant to be a quick-fix. From the start, it was a long-term commitment. It was a case of 'think big, start small'.

In 2014, after 45 years absence, I was fortunate to return to Gorongosa. The visit was both depressing and uplifting. The once abundant herds of buffalo, elephant, hippo, zebra, wildebeest and hartebeest had declined dramatically, although they were already in the process of recovery. The proud lions that had occupied some abandoned outpost buildings in the 1960s were gone. But the breath-taking beauty of the Urema floodplain, gigantic lemon-yellow fever trees and staggeringly large populations of waterbuck – now over 55,000 – were scenes demonstrating conservation success after an apocalyptic collapse. Reedbuck, oribi and bushbuck were even more numerous than in the 1960s, possibly reflecting the absence of predators such as leopard, hyena and hunting dog. By the 1990s these species had become locally extinct. Waterbuck numbers skewed the biomass distribution, and indicated the need for strengthening the predator diversity, in addition to reinforcing the herbivore populations. But that was 2014. Actions and results have accelerated over recent years (Fig. 5.4).

The Gorongosa Project (GP) – no longer called the Gorongosa Restoration Project – now has a holistic approach to the long-term socio-economic-ecological system. The Gorongosa Project's 30-year strategy spells out its ambitious vision: "A thriving, biodiversity-rich, Greater Gorongosa conservation landscape, which supports Sofala Province as an engine for resilient and sustainable development enabling nature experiences and wellbeing for its people, enriching all of Mozambique and the world." By 2019 the park and its adjoining conservation areas were being expanded as land-use agreements and transfers were negotiated, incremental steps towards the grand design of a park extending from Mount Gorongosa, across the Rift Valley and the Cheringoma Plateau to the Zambezi river floodplains of Marromeu and the sea – from the mountain to the mangroves – as originally proposed by Tinley (1977, 2021) in his benchmark ecological study.

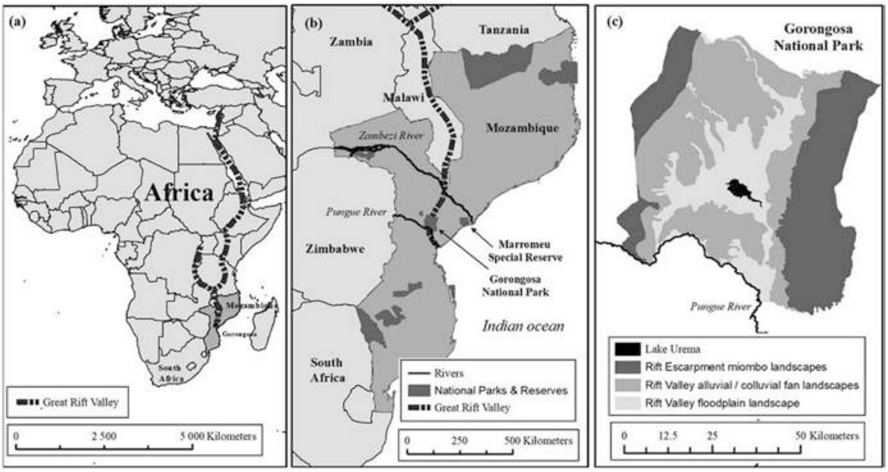

Fig. 5.4 Map of Gorongosa National Park, Mozambique, in relation to the Great Rift Valley, other protected areas and Gorongosa landscapes. (From Stalmans et al. (2019), PLoS/ONE Creative Commons)

5.3 Winds of Change: Cyclones and Peace

Much of the progress has been due to the dynamic leadership of a strong, competent and committed team of biodiversity professionals. But as with so many conservation projects in Africa, politics and people, not biologists, govern the future of wildlife. Two events during 2019 had major positive impacts on both the development process and public perceptions of the GP.

First, in March 2019 a singular event tested and demonstrated the human resource capacity and community commitment of the GP. A tropical cyclone, Idai, surged inland from the Indian Ocean and brought floods and destruction to much of central Mozambique and neighbouring Zimbabwe (Gorongosa Project 2021). GP team members acted as first responders, backed by the project's helicopters. Rescue missions delivered food and medical support by foot, canoe, vehicles and air. Over 500 tonnes of food was distributed to 80,000 people. Maize and bean seeds were provided to farmers throughout the park buffer zone to assist in crop recovery. The GP team led the rescue and rehabilitation responses for the people of the greater Gorongosa landscape. The very existence of the park, as a hydrological buffer and sink to much of the flood waters, proved its importance as an ecological service provider to the wider community.

Second, and even more significant for the long-term success of Gorongosa was the historic ceremony, held at the park headquarters, Chitengo, in August 2019 to celebrate the 'Cessation of Hostilities Accord' between the leaders of the Government of Mozambique and the opposition Renamo Party. The accord established Gorongosa as a 'Park for Peace'. Today, a new sense of the possible prevails, where once deep-rooted concern and anxiety had been a shadow over the project.

Table 5.1 Estimates of wildlife species populations in Gorongosa National Park, 1972–2020. (Stalmans et al. 2019)

Species	1972 estimate (Tinley 1977)	2000 estimate	Losses 1972–2000 (%)	2020 Population	Recovery as % of original population	Recovery as % of Original numbers
Buffalo	14,000	<100	>99	>1200	8	>8
Elephant	2500	<250	>90	>800	32	>30
Hippo	3500	<100	>97	>750	21	>20
Waterbuck	3500	<300	>91	>52,000	1480	>100
Zebra	3500	<20	>99	<50	1	<2
Blue wildebeest	6500	<20	>99	>800	12	>10
Sable antelope	700	<100	>86	>600	85	>85
Lichtenstein hartebeest	800	<100	>88	>500	62	>60
Lion	>200	<30?	>85	>150	75	>75

Fueling the optimism of participants in the GP has been the remarkable recovery of wildlife populations. Stalmans et al. (2019) and Gaynor et al. (2020) describe the rise and fall and rise again of the mammal populations of the park, from the 1960's peak, to the abyss of 2000, to the new peaks of 2021. By 2002, all species had lost upwards of 85% of their 1960s numbers. But since the implementation of effective poacher controls and the re-introduction of small breeding nuclei of key species, the recovery has been remarkable – as summarised in Table 5.1.

The dramatic changes in predator-prey structures (Pansu et al. 2018) have provided a novel opportunity to examine the trophic cascade in the park (Atkins et al. 2019) and the impact on vegetation structure (Daskin et al. 2015; Herrero et al. 2017) and functioning (Becker et al. 2021; Correia et al. 2016; Guyton et al. 2020). The predator-prey imbalances of Gorongosa have been addressed by strengthening the lion population (Bouley et al. 2018), now close to 200 individuals, and the re-introduction of African wild dogs, now over 150 (Bouley et al. 2021). Re-introductions of leopard started in 2019, and a small clan of spotted hyena were released in 2022. In fact, the wildlife populations are recovering so significantly that the park has been able to commence game translocations from its own sable, waterbuck, oribi, warthog and reedbuck populations in the re-wilding of Zinave National Park and Maputo Special Reserve (Gorongosa Project 2021).

5.4 The Socio-Ecological-Science System

Since 2005, the project has mobilised the investment of more than US$120 million in partnership with multiple donors. Project staff has increased from less than 100 to over 1000, 98% of whom are Mozambican with the majority of them coming from the surrounding Buffer Zone. Health, education and agricultural development activities are touching the lives of 200,000 people in the Buffer Zone around the Park (Easter et al. 2019). It has built four schools, provides bursaries for 37 girls to attend high school, and runs Nature Clubs in 50 primary schools involving over 2000 girls. The GP supports 88 community health workers, 129 traditional birth attendants and 159 'model moms' in the districts adjoining the Park (Gorongosa Project 2021).

Increased emphasis is now being given to community-based natural resource management, drawing on the experience of the Namibian Association of CBNRM Support Organisations (NACSO). The GP is taking advantage of the Mozambican Conservation Law of 2017 that provides for the establishment of Community Conservation Areas (CCA) as part of the formal protected area system. CCAs provide communities with the rights to manage resources themselves and the opportunities to benefit from sustainable use of these resources. Maxi Louis and Brian Jones from NACSO have been supporting the work of the GP in assisting local communities to establish CCAs or 'conservancies' as the GP is also calling them. An important characteristic of the GP has been its readiness to embrace the advice and experience of colleagues across southern Africa. In 2021, the first three Community Conservation Areas were formally established in the Sustainable Development Zones adjoining the Park (Gorongosa Project 2021).

The GP agricultural livelihoods programme focuses on two objectives – inclusive value chains, and farming for biodiversity. This is best illustrated by the Mount Gorongosa Coffee project. On sites where montane forest had been damaged by past slash-and-burn practices, indigenous trees are being planted to provide shelter and shade for coffee. Where previous slash and burn practices had led to eroded gullies, the planting of indigenous woodland and forest tree species is building a closed canopy which secures the soils and provides shade for the coffee trees. The bird, small mammal and other fauna of wooded communities are returning to the previously barren hillslopes. The activity has accelerated since the Peace Accord, with 200 ha now planted. A record 600,000 coffee trees were planted in 2021. Over 400 farmers are involved, providing a sustainable cash income. Gorongosa Coffee is the first coffee ever exported from Mozambique, with six tonnes of the first crop of over 100 tonnes of green coffee being exported to the United States in 2021. Beyond the coffee programme, GP agricultural extension services reach 10,000 farmers, with specific support for cashew and honey producers.

The science programme is now one of the most dynamic and best equipped in southern Africa, thanks to partnerships with over 30 institutions in the USA, Europe and southern Africa. The establishment of the E.O. Wilson Research Laboratory at the park headquarters, Chitengo, brings with it the prestige of one of Gorongosa's most illustrious champions. It also provides opportunities for Mozambican researchers to enhance their careers through mentorship projects and scholarships. The research programme includes studies on plant, vertebrate and invertebrate biodiversity. The All-taxa Biodiversity Inventory now exceeds 7500 species (Stalmans and Naskrecki 2019). New species, especially endemics, are being discovered and described (Branch et al. 2017; Janssens et al. 2018). Young professionals study in fields that range from the molecular systematics of ants and amphibia, to elephant ecology (Branco et al. 2019b; Gaynor et al. 2018), the genetics of primates (Martinez et al. 2019) and the exploration of the palaeontological treasures of newly discovered Miocene fossil beds (Habermann et al. 2019). Studies on human-wildlife conflict and mitigation strategies are being undertaken (Branco et al. 2019a, b). In July 2019 the E.O. Wilson Research Laboratory hosted a Wenner-Gren Foundation conference on primatology – the first ever to be convened in Africa. The science programme supports a two-year MSc course in conservation biology. The first two cohorts, each with 12 Mozambican students, graduated in 2020 and 2022. A third cohort will graduate in 2024. A new generation of Mozambican biologists is growing through applied field research in their country's most iconic landscapes.

5.5 Enter the Nay-Sayers

The Gorongosa Project has done much to build constituencies and the Gorongosa brand (Stalmans et al. 2018). But like many ambitious conservation projects in Africa, the early days of the Gorongosa Restoration Project were not free of criticism.

One short-term visiting researcher (Schuetze 2015) described emerging narratives – 'fortress narratives' – about the tensions between park-based actors and mountain residents. Based on visits to the area in 2006, 2008 and 2011, Schuetze's study was undertaken during a period of intense conflict between the two political factions that had been at war since 1973 – Frelimo and Renamo. Schuetze suggested that the GP invented a deforestation 'crisis' to support their proposal to have the mountain added to the park to protect the forests and the mountain's rich biodiversity. The assumption by Schuetze that the forests had not decreased in size, nor had such imagined decrease resulted from slash-and-burn cultivation, has not been supported by an objective analysis of high-resolution satellite imagery that showed very significant forest losses, with 45% of the forest having been lost between 1977 and 2021 (Stalmans and Victor 2022). These authors presciently describe the ongoing process of slash & burn deforestation as 'death by a thousand cuts'. The fragmentation of mature forests into patches is compounded by the drying out of the forest margins, increasing their vulnerability to regular fires.

The volatility of local communities was evident when I visited the GP reforestation project above the Murombodzi waterfall on the upper-slopes of Mount Gorongosa in late 2014. While admiring the robust growth of thousands of young indigenous forest saplings in the well-tended nursery, we were confronted by three armed Renamo soldiers, who asked us to leave. I assumed that they objected to the presence of GP rangers (who they might have considered to be aligned with their enemy, Frelimo), within the area of influence of Renamo. We later learned that the reason for their objection to our presence had no political overtones, but was simply due to the dismissal of one of their members from the reforestation project. The aggrieved party had been involved in the murder of a local villager, had absconded, was subsequently dismissed, and was fearful of arrest. Such tensions within local communities can easily lead to polarised views on and mis-interpretations of rural development projects such as the GP.

The dual-narrative line of argument was expanded in an entertaining and elegantly written but generally cynical book authored by American journalist Stephanie Hanes (2017). Hanes, like Schuetze, takes a short-term view, and a somewhat selective choice of evidence in her critique of the Gorongosa Project. Failure by the GP to take into account and solve the socio-economic problems of the people of central Mozambique within the early years of the original GP is seen as failure of the project as a whole. That centuries-old tensions between tribal groups could not be resolved in the first decade of the GP, and that health, education, communication and agricultural development were not the first priority of a privately sponsored initiative, was characterised as a neo-colonial exercise. In Hanes' view, once again, Westerners had failed in their attempt to try to help Africa. Greg Carr and the GP team, with fixed mindsets, were considered deaf to the perceptions and stories of the local communities. What Hanes ignored were the multiple challenges of conservation initiatives across Africa, where weak governance, collapsed institutions, corruption, industrial-scale poaching and poverty are endemic. A quick-fix solution to all of Africa's problems is what many short-term visitors to the continent so earnestly desire. They cynically chose to ignore success stories, such as the GP undoubtedly represents, in favour of seeking failure, large or small.

With the power of hindsight, perhaps the processes of community engagement in the formative years of the GP did not always follow what are now seen as best practises for community engagement. Community relations and partnership development require flexibility, respect, trust, participation, integration, relevance and empowerment (Lichtenfeld et al. 2019). These clear principles are easy to summarise in textbooks, but challenging to implement on the ground. The key elements require years, even decades, to consolidate.

5.6 Gorongosa as a 'Human Development Engine'

That the evolving Gorongosa Project has moved beyond the initial challenges is demonstrated in a statement by Greg Carr (2019):

"By reframing Gorongosa National Park as a 'human development engine,' we are supporting and enhancing national health services, agricultural programs, and education for local people, trying to lift them out of poverty and create more support for the park in a positive feedback loop—with a special focus on providing more opportunities for women and keeping girls in school."

As today's visitors to Gorongosa can attest, actions speak louder than words. What has been achieved since my 2014 visit would astonish any experienced observer of conservation action in Africa. Gorongosa is providing a powerful stimulus for the local economy, in an area plagued by poverty, poor infrastructure, malaria and low agricultural productivity. The Gorongosa Project, as a model of government/private sector collaboration, demonstrates what can be achieved in a relatively short time in Africa. The Mozambique government had the foresight to understand the advantages of partnering in good faith with a private philanthropist. Mutual trust and a common vision built a network of local communities and foreign expertise to rapidly rehabilitate a fractured ecosystem.

With an annual budget of US$16 million, of which 56% comes from foundations, philanthropy and donations, and 44% from cooperation partners (Gorongosa Project 2021), the GP still has a way to go before becoming financially self-sustaining. However, financial independence is a dream that no large protected area in Africa has yet attained. What is more important is that the financial model adopted by the GP is vibrant, innovative and adaptive. Its performance over the decade since the far-sighted partnership agreement was signed between the government of Mozambique and the Greg Carr Foundation is a model for any African protected area to follow.

5.7 Lessons Learned

In his succinct review of the drivers of success in two very different protected areas – Costa Rica's Área de Conservación Guanacaste and Mozambique's Parque Nacional da Gorongosa, Princeton University ecologist Robert Pringle (2017) highlights eight pillars of upgrading and expanding protected areas. With specific reference to Gorongosa, Pringle's messages can be summarised as follows:

- *Protect remaining refuges, and harness nature's resilience*: GNP provides the core area for the regional programme of biodiversity rehabilitation;
- *Upsize and inter-connect*: the GP has negotiated the proclamation of the uplands of Mount Gorongosa as an extension of GNP, and has been commissioned to manage a large hunting concession area and to establish a wildlife corridor between the concession area and GNP;
- *Be long-term and local*: the GP set a minimum of a 20-year framework for its public-private partnership, which has already been extended. Its work programme focuses on local communities as the primary stakeholders of the strategy;
- *Pay the opportunity costs*: the substantial investments by the GP in education, health care and agricultural extension are key drivers of socio-economic development in the region;
- *Develop creative financial strategies*: the initial investment of a private philanthropist – Greg Carr – has been increased multiple times through co-financing and in-kind support from over 20 corporations, NGOs, academic institutions and governments;
- *Know thy biodiversity*: founded on the early surveys of Ken Tinley (1977, 2021) – and rapidly expanded by the GP through the activities of the E.O. Wilson Research Laboratory, the knowledge base of GNP is one of the best for any protected area in Africa;

- *Be adaptable*: the courage of the government of Mozambique to initiate a public-private partnership with the Greg Carr Foundation, and the willingness of both partners to adopt a 'learning by doing' approach, required a large measure of adaptability as new challenges and opportunities arose; and
- *Involve young people*: the broad base of the GP's involvement with local communities, park staff, academics, students and researchers has capitalised on the energies and passion of youth.

What Robert Pringle did not highlight was the availability, within southern Africa, of an extensive network of wildlife conservation professionals and business models that could be adapted rapidly to Gorongosa's needs and opportunities. Fortunately, the Mozambican authorities took a leap of faith in accepting the support of their immediate neighbours, including countries with which they had been at war for decades. This example of regional collaboration in conservation research and action is one of the many 'peace dividends' coming out of the political transformation in the region since 1990. Greg Carr, knowingly or not, seized the political moment while imagining the future.

References

Atkins JL, Long RA, Pansu J et al (2019) Cascading impacts of large-carnivore extirpation in an African ecosystem. Science 364:173–177. https://doi.org/10.1126/science.aau3561

Becker JA, Hutchinson MC, Potter AB et al (2021) Ecological and behavioral mechanisms of density-dependent habitat expansion in a recovering African ungulate population. Ecol Monogr 00(00):e01476. https://doi.org/10.1002/ecm.1476

Bouley P, Poulos M, Branco R et al (2018) Post-war recovery of the African lion in response to large-scale ecosystem restoration. Biol Conserv 227:233–242

Bouley P, Paulo A, Angela M et al (2021) The successful reintroduction of African wild dogs (*Lycaon pictus*) to Gorongosa National Park, Mozambique. *PLoS ONE* 16(4):e0249860

Branch WR, Guyton JA, Schmitz A et al (2017) Description of a new flat gecko (Squamata: Gekkonidae: *Afroedura*) from Mount Gorongosa Mozambique. *Zootaxa* 4324(1):142–160

Branco PS, Merkle JA, Pringle RM et al (2019a) An experimental test of community-based strategies for mitigating human–wildlife conflict around protected areas. Conserv Lett 2019:e12679

Branco PS, Merkle JA, Pringle RM et al (2019b) Determinants of elephant foraging behavior in a coupled human-natural system: is brown the new green? J Anim Ecol 88:780–792. https://doi.org/10.1111/1365-2656.12971

Carr G (2019) The Gorongosa model. In: Lichtenfeld LL, Naro EM, Snowden E (eds) Community, conservation, and collaboration: a framework for success. National Geographic Society/African People & Wildlife, Washington D.C/Arusha

Correia M, Timóteo S, Rodriguez-Echeverria S et al (2016) The refaunation and the re-instatement of the seed-dispersal function in Gorongosa National Park. Conserv Biol 31:76–85. https://doi.org/10.1111/cobi.12782

Daskin JH, Stalmans M, Pringle RM (2015) Ecological legacies of civil war: 35-year increase in savanna tree cover following wholesale large-mammal declines. J Ecol 104:79–89. https://doi.org/10.1111/1365-2745.12483

Easter T, Bouley P, Carter N (2019) Opportunities for biodiversity conservation outside of Gorongosa National Park, Mozambique: a multispecies approach. Biol Conserv 23:217–227. https://doi.org/10.1016/j.biocon.2019.02.007

Gaynor KM, Branco PS, Long RA et al (2018) Effects of human settlement and roads on diel activity patterns of elephants (*Loxodonta africana)*. Afr J Ecol 56:872–881

Gaynor KM, Daskin JH, Rich LN et al (2020) Postwar wildlife recovery in an African savanna: evaluating patterns and drivers of species occupancy and richness. Anim Conserv 13:510–522. https://doi.org/10.1111/acv.12661

Gorongosa Project (2021) Our Gorongosa – together we are stronger. Parque Nacional da Gorongosa, Mozambique 44 pp. https://www.yumpu.com/en/document/read/66210012/2021-gorongosa-annual-report

Guyton JA, Pansu J, Hutchinson MC et al (2020) Trophic rewilding revives biotic resistance to shrub invasion. Nat Ecol Evol 4:712–724. https://doi.org/10.1038/s41559-019-1068-y

Habermann JM, Alberti M, Aldeias V et al (2019) Gorongosa by the sea: first Miocene fossil sites from the Urema rift, Central Mozambique, and their coastal paleoenvironmental and paleoecological contexts. Palaeogeogr Palaeoclimatol Palaeoecol 514:723–738

Hanes S (2017) White Man's Game: saving animals, rebuilding Eden and other myths of conservation in Africa. Metropolitan Books, New York, p 287

Herrero HV, Southworth J, Bunting E et al (2017) Using repeat photography to observe vegetation change over time in Gorongosa National Park. Afr Stud Q 17(2):65–82

Janssens SB, Ballings P, Mertens A et al (2018) A new endemic *Impatiens* species on Mount Gorongosa (Mozambique) demonstrates the conservation importance of montane areas in Africa. Phytotaxa 333(1):73–85. https://doi.org/10.11646/phytotaxa.333.1.5

Lichtenfeld LL, Naro EM, Snowden E (2019) Community, conservation, and collaboration: a framework for success. National Geographic Society/African People & Wildlife, Washington D.C/Arusha

Martinez FI, Capelli C, Ferreira da Silva J et al (2019) A missing piece of the *Papio* puzzle: Gorongosa baboon phenostructure and intrageneric relationships. J Hum Evol 130:1–20. https://doi.org/10.1016/j.jhevol.2019.01.007

Pansu J, Guyton JA, Potter AB et al (2018) Trophic ecology of large herbivores in a reassembling African ecosystem. J Ecol 107:1355–1376. https://doi.org/10.1111/1365-2745.13113

Pringle RM (2017) Upgrading protected areas to conserve wild biodiversity. Nature 546:91–99. https://doi.org/10.1038/nature22902

Schuetze C (2015) Narrative fortresses: crisis narratives and conflict in the conservation of mount Gorongosa, Mozambique. Conserv Soc 13:141–153. http://works.swarthmore.edu/fac-soc-anth/145

Stalmans M, Naskrecki P (2019) The role of biodiversity inventories in the management of Gorongosa National Park. In: Wilson JW, Primack RB (eds) Conservation Biology in Sub-Saharan Africa. OpenBook Publishers, pp 300–302

Stalmans M, Victor M (2022) Forest cover on Gorongosa mountain. Assessment of 2021 satellite image. Gorongosa National Park, Chitengo. 18 pp

Stalmans M, Carr G, Galante V et al (2018) Como criar uma marca e uma base ampla de seguidores ao redor do Parque Nacional Gorongosa, Moçambique. In: Jiménez Pérez I (ed) Produção de Natureza: Parques, rewilding e desenvolvimento local. SPVS, Curitiba, pp 176–179

Stalmans M, Massad TJ, Peel MJS et al (2019) War-induced collapse and asymmetric recovery of large- mammal populations in Gorongosa National Park, Mozambique. *PLoS ONE* 14(3):e0212864

Tinley KL (1977) Framework of the Gorongosa ecosystem, Mozambique. PhD thesis, University of Pretoria

Tinley KL (2021) Montane to mangrove – framework of the Gorongosa ecosystem, Mozambique. Gorongosa Project, Chitengo

Wilson EO (2014) A window on eternity. A biologist's walk through Gorongosa National Park. Simon & Schuster, New York. 149 pp

Chapter 6
Overcoming the Taxonomic Impediment: SABONET and the African Plants Initiative

The taxonomic impediment consists of several problems: the incomplete knowledge of the largely unknown global biodiversity, the insufficient number of experts and their unbalanced distribution across the globe and the taxonomic infrastructures that are not meeting the demands yet.

Charles Coleman (2015) *Taxonomy in Times of the Taxonomic Impediment*

6.1 The Long Walk to the GEF

Sunday 11 February 1990 dawned brightly over southern Africa, nowhere more so than in Cape Town, as the sun's golden rays lit up the slopes of Table Mountain, the tourist icon of the Republic of South Africa. For some people, the mountain's silhouette portrayed a vision of another country, staring down as it did on Robben Island. The calm beauty of the scene belied a palpable tension in the morning air. It was the day on which Nelson Mandela would end his long walk to freedom (Mandela 1994). From the early hours of the morning, tens of thousands of ANC supporters, throngs of diplomats from across the globe, and a swarming mass of international media waited, apprehensively, almost in disbelief. This was the day on which Nelson Rolihlahla Mandela would be released from over 27 years of incarceration.

In Maputo, two thousand kilometres way, just beyond the north-eastern border of South Africa, a rather different group of Africans was developing a strategy for collaboration among plant scientists in a post-Apartheid southern Africa (Fig. 6.1). Thirty biologists from a dozen African countries had spent a week discussing research and coordination needs and opportunities to mobilise a new dawn for the plant sciences in the region. Southern Africa was soon to be freed from the tensions and isolation that had characterised relations between South Africa, its neighbours and the world since 1948, the year in which policies of segregation and disenfranchisement became law under the country's Nationalist Party government.

B. J. Huntley, *Strategic Opportunism: What Works in Africa*, SpringerBriefs in Environmental Science, https://doi.org/10.1007/978-3-031-24880-1_6

Fig. 6.1 Plant scientists from across southern Africa meet in Maputo, Mozambique, to formulate a collaborative programme for the post-Apartheid era. February 11, 1990

That Sunday morning, at the conclusion of the Maputo workshop's discussions, the participants walked down the potholed streets of the Mozambican capital to join a small gathering of excited people. As the hot day wore on, the crowd grew, singing resistance songs, dancing up clouds of dust, and waving tattered banners calling for the release of Nelson Mandela. We arrived in front of a rather run-down building which housed the African National Congress (ANC) headquarters in Mozambique. A local radio station broadcast the proceedings from Cape Town, relayed via loudspeakers for the benefit of the crowd. A mix of excitement and fear embraced the gathering. It was clear that some delays were being experienced in the release process. One nervous workshop delegate received a message from the Cape. There had been a right-wing attack on Mandela; rioting had broken out; Mandela had been re-arrested. Much noisy protest erupted in the crowd, but fortunately was soon calmed by what was to become the unforgettable, unmistakable, deep intonation and inspiring voice of Nelson Mandela as he addressed the wildly rejoicing crowds assembled in front of the Cape Town City Hall.

Sunday 11 February 1990 became a defining timeline in Africa's history. A less well documented narrative is that of the transformation in botanical and conservation actions that followed the heady days of the early 1990s. Here I describe two initiatives that could not have happened without political change in the region. The first, SABONET, led seamlessly into the second, the African Plants Initiative.

The Maputo meeting was a rather cathartic process for participants from South Africa, cut-off as they had been from free movement across the continent by political and academic isolation for several decades. Here, in Maputo, for the first time, we could work together with colleagues from many African states, states whose governments endorsed the United Nations declaration that Apartheid was a crime against humanity and had legislation to arrest any South African arriving in their country. The meeting was remarkably free from any rancor, and from the first day agreement was reached to establish a 'Network of Southern African Plant Scientists – NESAPS', specifically to promote information exchange, training opportunities, collaborative studies and to publish a regional journal. *Leadership* would rotate between countries, with the first two-year term based at the National Herbarium of Malawi. The context of the meeting included a view that much of post-colonial Africa had suffered from the paradox of a steady erosion of national collections (of plant and zoological specimens) simultaneous to the rise in international and national concern for biodiversity conservation. An African approach to the paradox was needed, and ambitious action plans were developed and approved by acclamation. We then walked down to the ANC celebrations.

Following the Maputo workshop, meetings were held in Zomba (Malawi) in April 1991 and in Bulawayo (Zimbabwe) in March 1993, but little progress was reported. It was widely assumed that the NESAPS initiative was dead. But events on the international horizon gave signals of hope. In June 1992 the United Nations Conference on the Environment and Development had been convened in Rio de Janeiro, Brazil, setting new global agendas for conservation. Two key outcomes were the Convention on Biological Diversity (CBD 2018) and the establishment of the Global Environment Facility (GEF). The first set clear policy directions for governments and the broader community to achieve biodiversity conservation goals, and the second provided a financing mechanism to support conservation action in developing countries.

In South Africa, the political mood since February 1990 had been swinging from elation to deep depression as negotiations between the government and representatives of the ANC, IFP, SACP, PAC and other liberation movements were undermined by violent interference from both right-wing and left-wing extremists. But the spirit of the Maputo meeting was kept alive. A further regional workshop was convened in September 1993 at Kirstenbosch National Botanical Garden, Cape Town, which brought together 140 botanists from 14 African countries. The Kirstenbosch workshop produced a regional synthesis on southern Africa's botanical diversity (Huntley 1994), plus a strategic plan to mobilise an ambitious vision of a training and capacity development network. The project would be called the Southern African Botanical Diversity Network (SABONET). All that was needed was a generous donor to fund the project. This is where the 'Long Walk to the GEF' began.

Armed with the proceedings of the Kirstenbosch workshop, communication with a wide range of potential donors commenced. Initial responses were not encouraging. As a logical but problematic policy in the new political landscape of South Africa, all foreign donors focused their support on the priorities of the former liberation movements, not on any activity led by a South African statutory institution – such as the then National Botanical Institute (NBI), hosts of the Kirstenbosch meeting.

Despite these challenges, the view of the leadership of NBI was clear – the opportunities created by the CBD and GEF were too good to miss. The timing seemed perfect, or nearly so, for SABONET. In October 1993 I wrote to an old friend, Chilean ecologist Eduardo Fuentes, who was then with the United Nations Development Programme (UNDP), based in New York. I sent him a draft of the Kirstenbosch proceedings, now in the format of a funding pre-proposal to the GEF. A reply soon arrived to remind me that South Africa was not yet recognised as a member of the United Nations, having been expelled on 30 September 1974, and as such could not qualify for UNDP support. Undaunted, we waited patiently for South Africa's first democratic elections, held in April 1994, followed by the inauguration of Nelson Mandela as its first democratically elected president on 11 May. South Africa was re-admitted to the UN General Assembly on 23 June 1994.

The path now seemed open for SABONET. In September 1994 another proposal was sent to UNDP, and this was approved by GEF/UNDP for 'initial development'. In March 1995 the revised 'Project Brief', having passed a technical review by UNDP, was held back from approval because South Africa had not yet ratified the CBD. Although South Africa had signed the CBD on 4 June 1993, it was not to become a member state to the Convention until 2 November 1995. The goal posts of the GEF seemed to keep moving.

By this time a new GEF contact person, John Hough, had been appointed at UNDP. Hough had years of experience in Africa, and was willing to play the long game. He guided us through the next steps, which required not only the complete revision of our initial rather naïve project outline, but also inclusion in the project document of signed statements, on official government letterheads, from each of the ten southern African countries that would participate in the project. This step proved to be one of the most complicated. Communications between African countries did not then enjoy the speed of the internet, and two countries, Angola and Mozambique, required all working documentation to be submitted in Portuguese. But we persisted, and by late 1995 the Project Document was dispatched to the UNDP offices in New York. I soon received a sympathetic but sobering reply from John Hough. The project proposal was excellent, but funding was not available until the second phase of GEF, that would only commence in 1997.

Unexpectedly, and fortuitously, an interim arrangement could be made. In September 1995, simultaneous to the news that GEF could not initiate funding until 1997, the International Union for the Conservation of Nature (IUCN) Regional Office for Southern Africa (ROSA) in Harare, Zimbabwe, had received funding from USAID for a Regional Capacity Building Network for Southern Africa (NETCAB). Through the support of Achim Steiner, then director of ROSA (and later Executive Director of UNEP and now Administrator of UNDP), SABONET was able to access seed funding to start its activities.

SABONET was now on a fast track. It held its first Steering Committee in Pretoria in March 1996, and in June 1996 the NBI appointed a highly competent Project Coordinator, Christopher Willis. With all arrangements in place, the project commenced training programmes, field trips and herbarium rehabilitation in its ten member countries – Angola, Botswana, eSwatini, Lesotho, Malawi, Mozambique, Namibia, South Africa, Zambia and Zimbabwe (Fig. 6.2).

Fig. 6.2 Participants from ten African herbaria at a field-based training course. (Photo: Christopher Willis)

With the project mobilised through NETCAB funding, negotiations with GEF continued. When we assumed that everything was in place, a further hurdle was presented – neither Angola nor Namibia had yet ratified the CBD. They could thus not receive GEF funds. A compromise could be arranged, given that IUCN ROSA could fund the activities in Angola and Namibia until these countries had ratified the convention. Further delays and multiple iterations of the Project Document (affectionately called the ProDoc in UNDP-speak) were exchanged between Cape Town and New York. In April 1996 the GEF Council approved SABONET, but the ProDoc needed the GEF CEO's signature – which was inexplicably delayed until September 1997. Eventually, after eight member countries had signed the approved document, the final ProDoc was signed by the UNDP Resident Representative in Pretoria on 20 January 1998. From 1 April 1998 the GEF funds became available. After a gruelling four and a half years of negotiation, the Long Walk to the GEF was over.

6.2 The SABONET Model: Learning by Doing

GEF funding totalled US$4.7 million, matched by similar funding from the ten participating countries. The project was approved to run for four years, but due to careful fund management (and the devaluation of African currencies against the dollar) it ran for nine years, 1996–2005. The justification for the GEF/UNDP investment was the project's direct contribution to achieving CBD objectives and articles, in particular:

- Article 12. Research and Training – The Contracting Parties shall … establish and maintain programmes for scientific and technical education and training in measures for the identification, conservation and sustainable use of biological diversity … and provide support for such education and training for the specific needs of developing countries …
- Article 17. Exchanges of information – Each Contracting Party shall … facilitate the exchange of information …
- Article 18. Technical and Scientific Cooperation – The Contracting Parties shall … promote international technical and scientific cooperation … special attention should be given to the development and strengthening of national capabilities, by means of human resources development and institution building …

SABONET was designed as a 'south-south' solution to capacity building, specifically to accelerate training and infrastructure rehabilitation, and to accelerate field work by young botanists in poorly documented African ecosystems. The project could also help break the dependency on the intellectual resources of the north by many African institutions. There was a wide, but not necessarily accurate, perception in the region that in post-colonial Africa the indigenous and local knowledge and skills-base had been eroded. It is true that many students had been drawn away from Africa (to study for higher degrees in northern universities, remote from the realities, needs and environmental circumstances of Africa) and many such graduates either did not return, or if they did, they rapidly entered administrative posts.

At a broader level, support for national or regional botanical diversity inventory, evaluation and monitoring had been superficial. Such interventions had seldom generated either human or institutional capacity. Where botanical surveys had been undertaken, they were often done by foreign consultants. In many cases no new, original field information had been added to the national repository of knowledge; at worst, old information had been erroneously interpreted or synthesised and had thus made a negative contribution to global knowledge on biological resources. It was felt that the situation could only be reversed by an African-based, in-service and carefully targeted human capacity and institution building programme – SABONET.

The project commenced from a zero base. Never before had the curators of the herbaria of southern Africa been able to meet on a regular basis, even less to participate in field trips, or training workshops; far less to receive funding for the basic needs of functioning modern herbaria. SABONET provided the opportunity for active partnerships to develop not only between the leaders of regional herbaria and botanical gardens, but also for in-service training of young technical and research staff. Perhaps most importantly, computers were introduced to herbaria that had never before had internet communications, nor the benefit of electronic data archiving and analysis. Vehicles and field equipment allowed for extended collecting trips to areas of high biodiversity interest (Fig. 6.3). As important as the tangible products resulting from the project was the culture of collaboration between countries – south-south and north-south – that evolved during the successive training sessions, workshops, field trips and joint publications. At the time of the project, the

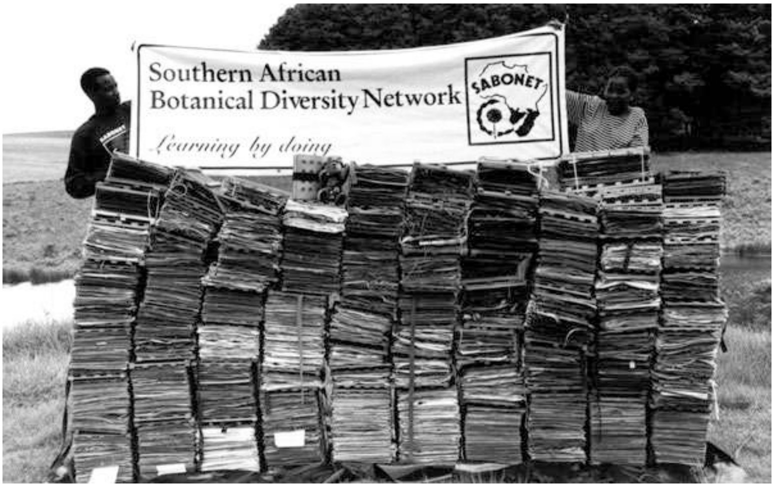

Fig. 6.3 Botanical collaboration in action: plant presses hold thousands of specimens collected during a SABONET expedition to the Nyika Plateau, Malawi, April 2000. (Photo: Christopher Willis)

internet and electronic social media were unavailable across most of southern Africa. Fortunately, the production of a hard copy *SABONET News* was a very effective medium to keep the work of all participants connected. The use of the *SABONET Report Series* also provided a rapid publication mechanism for the many technical guidelines, checklists, red data lists, field trip reports and progress reports that added to the tangible cohesion of participants and to the excitement that the project created among botanists throughout southern Africa.

The major works coming out of the *SABONET Report Series* (Fig. 6.4) including the massive compilations of the 19,518 species listed in the 892-page *Checklist of South African Plants* (Germishuizen et al. 2006) and the 50,136 species listed in the 1126-page *Checklist of the flowering plants of Sub-Saharan Africa* (Klopper et al. 2006a, b). By the early 2000s, the internet has become widely available and researchers were supported by online data bases and electronic versions of the SABONET publications, giving easy access to the project's results. The importance of these comprehensive compilations was in their provision of updated nomenclatural standards facilitating future botanical work, such as the African Plants Initiative, across the continent. The critical role of such standard checklists is frequently overlooked by the biodiversity conservation industry, where checklists or inventories of a site, a habitat, an ecosystem, a protected area, biome, country or continent are the basic building blocks of biodiversity knowledge. Until the SABONET project, such checklists did not exist for southern Africa nor for Africa south of the Sahara (Figueiredo and Smith 2008; Germishuizen et al. 2006). Nor were skills in electronic data management of herbarium collections available outside of South Africa.

Several reviews of the project have been published (Huntley et al. 1998, 2006; Siebert and Smith 2003, 2004; Steenkamp et al. 2006), while an independent GEF

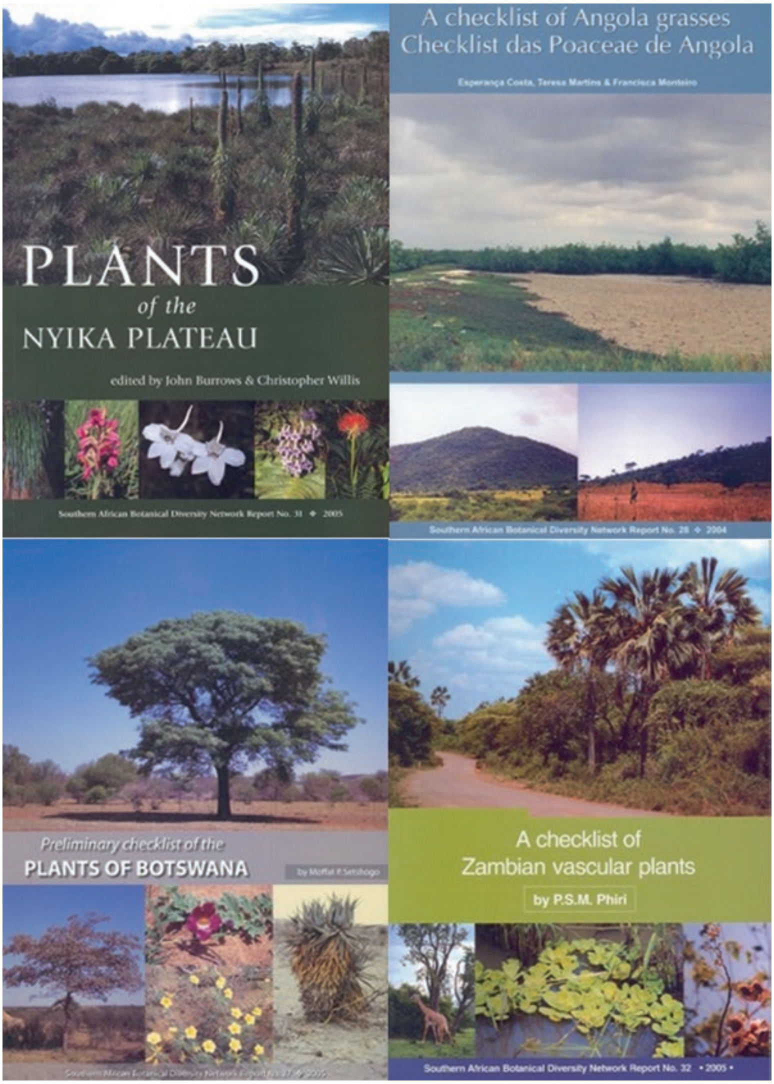

Fig. 6.4 Cover pages of some of the 43 volumes of the SABONET Report Series

terminal review (Simiyu and Timberlake 2005) gave the project a 'Highly Satisfactory' rating – the highest rank in the GEF evaluation system. Subsequent GEF publications have commented favourably on the quality of the project's products, most particularly on its publications, including 43 volumes in the *SABONET Report Series* and 24 numbers of *SABONET News*; its extended multi-national field trips in Botswana, Malawi and Mozambique; the compilation of floristic checklists for most of the 10 participating countries; plant red data lists; computerised data inventory of over 450,000 herbarium specimens; support of 26 students graduating with 36 higher degrees; and training of over 150 herbarium and botanical gardens technical staff. Many participants now hold senior positions in their national government and academic institutions. One is the Vice President of her country (Angola). In an extensive review of the history of plant taxonomy in South Africa, Victor et al. (2016) refer to SABONET as: "One of the most influential biodiversity capacity building initiatives globally."

6.3 Lessons Learned from SABONET

The GEF independent Terminal Review (Simiyu and Timberlake 2005) concluded that "SABONET has some unique elements that were responsible for its huge success that may not be easy to replicate in other contexts." These included:

- A strong project champion with institutional, regional and international support and presence;
- Visionary yet adaptable project leadership and management; a transparent and strong regional Steering Committee with consistent membership;
- Willing, focused and motivated team players in a regional context; and
- Highly experienced and committed support from the GEF Regional Advisor.

The above attributes were critical to the project's operational success. However, many underlying drivers were also at play, which had both strategic and operational influence on the project results. These included:

- The political transition in South Africa dating from the date of the release of Nelson Mandela in February 1990 (and all political prisoners soon thereafter), followed by democratic elections;
- The rapid political changes in South Africa which opened up unprecedented opportunities for collaboration not only across Africa, but also to access to international donor funding;
- The changing global environmental policy agenda – triggered by the Rio conference and the resultant CBD, UNFCCC, GEF and related initiatives;
- Plant scientists from across southern Africa who found innovative mechanisms to strengthen their profession through a 'south-south' solution;
- The availability of seed funding from IUCN-ROSA to initiate the project during the lengthy negotiations to obtain funding from the GEF;
- The colonial legacy, which included many herbaria, and locally trained botanists, some with many years of experience, and with the capacity to mentor a new generation of botanists;
- The availability of a large and strong institution (NBI) with the capacity to provide a highly skilled Project Coordinator – Christopher Willis – to drive the founding years of the project. Strong project administration skills within NBI proved a critical ingredient for success;

- Key management skills, available to competently process financial transfers to ten different currency areas, to obtain visas for travel by participants between countries, obtain import licences for vehicles and equipment, to convene and report on meetings, publish high quality journals and newsletters, and the multiple administrative requirements attending the management of donor funds;
- The availability of an advanced computer-based data management system for herbarium collections (PRECIS) which could be extended for use in all southern African countries, and the staffing for the transfer of such skills;
- The ability to make special arrangements to support the participation of the two Lusophone countries – Angola and Mozambique – to ensure that their participants were not disadvantaged by language barriers; and
- Serendipity – the good luck and good timing of seed funding from NETCAB while GEF funding was delayed; and of the simultaneous availability of inspired and mutually supportive leaders across many countries and institutions.

SABONET had developed a new professional culture within the southern African botanical community, one that facilitated collaboration in complex, computer-aided data and information sharing systems. The region was ready for an even more ambitious project.

6.4 Taxonomy on the Fast Track: The African Plants Initiative

The individual species of plants, mammals, birds, reptiles, etc. are the fundamental units of biodiversity science and conservation action. The identity of individual species within a given community or ecosystem is the first step in any biodiversity assessment. The reliability of species identifications is dependent on sound and testable taxonomies – the system by which peers around the globe agree on what Latinised binomials (scientific names such as *Adansonia digitata* – the baobab) are given to each clearly circumscribed species. Such names are permanently attached to what are called type specimens. Type specimens are typically the original plant material collected in the field, usually dried and compressed in a plant press, mounted on a cardboard sheet and permanently preserved and archived in an herbarium. The type specimen is the point of reference for all further uses of the name, once this has been published in a scientific journal. Fine scale molecular and genetic analyses, no matter how sophisticated, should all refer back to the original herbarium-based type specimen or in the very least the herbarium specimen of the plant from which a sample has been taken.

So far, so good.

Over the past three centuries, several million herbarium specimens have been collected in Africa for scientific research purposes. These specimens were mostly collected by visiting naturalists, scientists and colonial officials and sent back to herbaria and museums in their home countries such as Britain, France, Germany, Portugal, Belgium and the United States. The vast majority of these specimens, including their type specimens, were thus deposited in European and North American herbaria (Figueiredo and Smith 2010; Greve et al. 2016). For researchers based in poorly-resourced African institutions, access to the original type specimens has therefore been almost impossible. Students of African botany have not easily been able to examine the type specimens that determine the name that must be applied to a particular species. This has created an almost insurmountable barrier for the nurturing of African plant taxonomists. Like many biologists in developing countries, they have suffered from what has become known as the 'taxonomic impediment'.

This 'taxonomic impediment' results from the combination of large gaps in taxonomic knowledge, limited taxonomic infrastructure and the decline of species experts (Hoagland 1996; Huntley 2003; Wheeler et al. 2004; Coleman 2015; Soltis 2017). The term was first used in 1995 at a meeting of the International Union for Biological Sciences (IUBS) Steering Committee on which I then served. It described succinctly a basic challenge to biodiversity science in Africa. The taxonomic impediment was what we were addressing through SABONET. It was a problem that was soon to be resolved – not through any international committee or convention – but by the innovative action by one man – William (Bill) Robertson, a senior administrator with the Andrew W. Mellon Foundation.

I first met Bill Robertson in the 1980s, when we both served on various international science committees. Bill was the respected 'éminence grise' of these research strategising bodies. His insight of what new directions in science were needed to understand environmental problems, and his wide experience of what initiatives might be expected to have remarkable results, were demonstrated in the many programmes that had their origin and impetus through the support he gave to projects of the IUBS and SCOPE.

In June 2003, after a visit to Royal Botanic Gardens, Kew, Bill Robertson came up with an unusual proposal. He had visited the Herbarium, where researchers were busy making digital images of type specimens. By carefully placing herbarium sheets, face-upwards, onto a cushioned platform, and by means of a mechanism that lowered a flatbed scanner face-down onto the specimen, the researchers were able to electronically scan the material without risk of damage to the fragile, often centuries-old, specimens. The process of using the 'HerbScan' was slow and costly. But Robertson could see the value to international botanical scholarship of being able to make the treasures of Kew, and of many other major repositories of plant collections, available at the click of a button via the internet, and through establishing a single integrated portal. The huge costs to researchers in travel, or risks to specimens through postage to partner institutions, could be vastly reduced. More importantly, it would mean that the information housed in the institutions of the north could be transferred back to the countries of origin in the south at low cost to the recipient institutions. A key objective of the Convention on Biological Diversity – for the repatriation of information, if not the physical specimens themselves, to the former colonies of European countries – could be achieved.

Shortly after his visit to Kew, Bill Robertson was in South Africa, where he visited the various projects funded by his institution – the Andrew W. Mellon Foundation. Before returning to New York, Bill called on Gideon Smith, then research director of the South African National Biodiversity Institute (SANBI – previously the National Botanical Institute). They discussed the idea of mobilising all major herbaria holding African material to digitise the type specimens in their collections for free dissemination of the images and associated information, of all the plants of Africa. The proposal matched an earlier concept for a *Types of African Plant Names* project that Gideon Smith had been developing – but the funding required was considerable.

But Robertson was not daunted. At that time, the Andrew W. Mellon Foundation was actively supporting initiatives to advance and preserve knowledge and to improve teaching and learning through the use of digital technologies. For African botany, it was a case of good luck and good timing. After a quick return to New York, Robertson was back in South Africa the following week, and met with me, as Chief Executive of SANBI, to test his ideas for a collaborative project involving Kew, SANBI and the Mellon Foundation as initial partners. The network, if his proposals were accepted, could be expanded to embrace all African and major northern hemisphere herbaria. On behalf of SANBI, I immediately agreed, and within months the proposal was tested with the leaders of over twenty African herbaria and international collaborators on the flora of Africa.

Gathered for the 17th meeting of the Association for the Taxonomic Study of the Flora of Tropical Africa/*Association pour l'Etude Taxonomique de la Flore d'Afrique Tropicale* (AETFAT) in Addis Ababa in September 2003, the directors of Africa's key herbaria convened an impromptu meeting to consider Robertson and Smith's proposal. The then director of Kew, Peter Crane, chaired the meeting, and outlined the proposal, which was eagerly received by all participants. That same evening a formal proposal was prepared by Gideon Smith, discussed the next morning with Alan Paton of Kew, and within the week this had been submitted to the Andrew W. Mellon Foundation and approved for funding. Never before in the history of botany in Africa had a major project been so rapidly conceived, formulated, scrutinised by peers from across the continent and approved for funding (Smith 2004; Smith and Figueiredo 2010; Smith et al. 2011; Nic Lughadha and Miller 2009).

The African Plants Initiative (API) moved rapidly, building on the experience of SABONET, with NBI/SANBI providing much of the guidance for African herbaria (Walters et al. 2010). A meeting of partners was held at Kirstenbosch in February 2004, and subsequent meetings in South Africa (Fig. 6.5), Cameroon and Kew guided the programme to success. By the end of the API project in 2008, 291,289 images of specimens were available electronically, 51,822 from African, 231,171 from European, and 8296 from North American herbaria (Smith et al. 2011).

Guided by an earlier user needs assessment (Steenkamp and Smith 2002, Fig. 6.6), the combined activities of SABONET and the African Plants Initiative stimulated a number of satellite projects, such as the checklist of the flora of sub-Saharan Africa (Klopper et al. 2006b, Fig. 6.7); a checklist of the flora of Angola

Fig. 6.5 Plant taxonomists from 45 partner institutions meet in Kirstenbosch, Cape Town, for the 5th African Plants Initiative workshop, November 2008. (Photo: Chris Cupido)

(Figueiredo and Smith 2008; Smith and Figueiredo 2010) and of the lycophyte and fern flora of Africa (Roux 2009).

What had seemed an insurmountable challenge in 2003 – to digitise the type specimens of sub-Saharan Africa's over 50,000 species – was completed by 2008 through a network of 73 global partners and was available, electronically, to the world botanical research community. This vast Africa plants electronic database is hosted by JSTOR, a subsidiary of Ithaka, a not-for-profit organisation founded by the Andrew W. Mellon Foundation and dedicated: "to help the academic community use digital technologies to preserve the scholarly record and to advance research and teaching in sustainable ways." The products of the API are available online to participating African institutions at JSTOR Global Plants website http://plants.jstore.org.

6.5 The African Plants Initiative Tradition Expands to Latin America and Australasia

The success of the API led the Mellon Foundation to add its support to a similar initiative, the Latin American Plants Initiative (LAPI), which together with the API, soon morphed into the Global Plants Initiative (GPI) (Ryan 2013). The global reach and influence of the herbarium digitisation agenda and the chain of activities linking API to LAPI to GPI is no better illustrated than the timely access to Mellon Foundation support by Australian herbaria to digitise their collections. During the

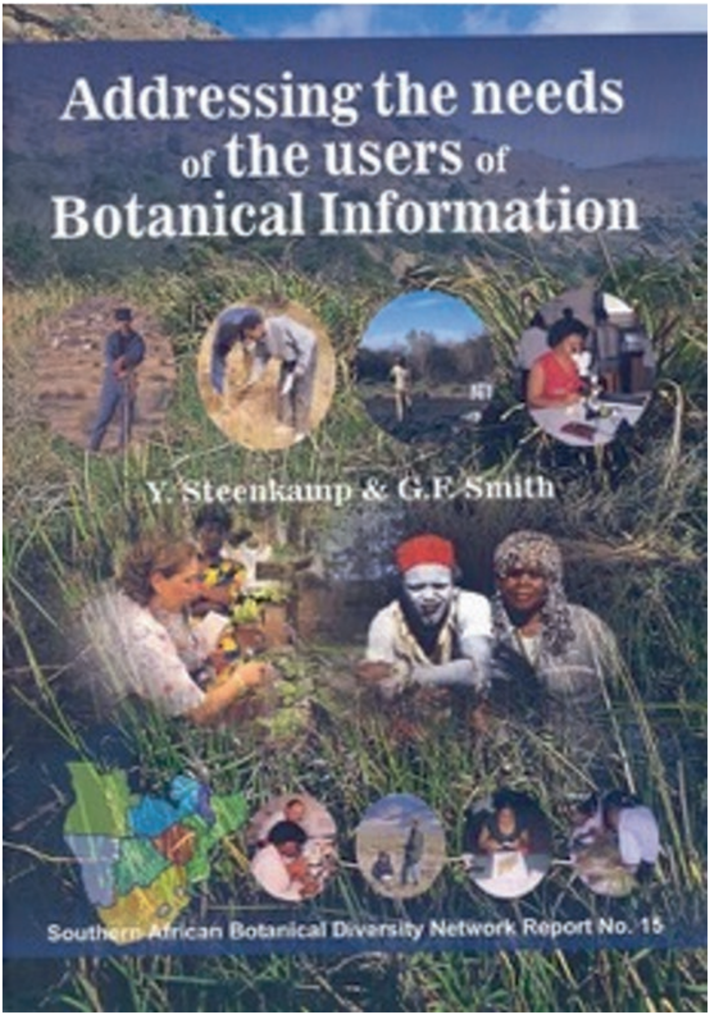

Fig. 6.6 Volume 15 of the SABONET Report series identified the user needs for botanical information. (Steenkamp and Smith 2002)

global financial crisis of 2008, the Australian government was investing in national infrastructure capabilities, including the Atlas of Living Australasia (ALA). The Mellon grant of US$540000 helped launch what was to become a major programme of biodiversity information systems – fortuitously at the moment when such a catalyst was critically needed. The grant facilitated the acquisition of imaging equipment and supported the digitisation of 71,281 types. In the words of David Cantrill, Executive Director, Science, at Royal Botanic Gardens Victoria, the GPI: “Is a phenomenal resource for the Plant Systematic and Taxonomy Community. Staff in my institution use it continually. Australian herbaria continue to supply type images to JSTOR.” (Cantrill, pers. comm. 2019).

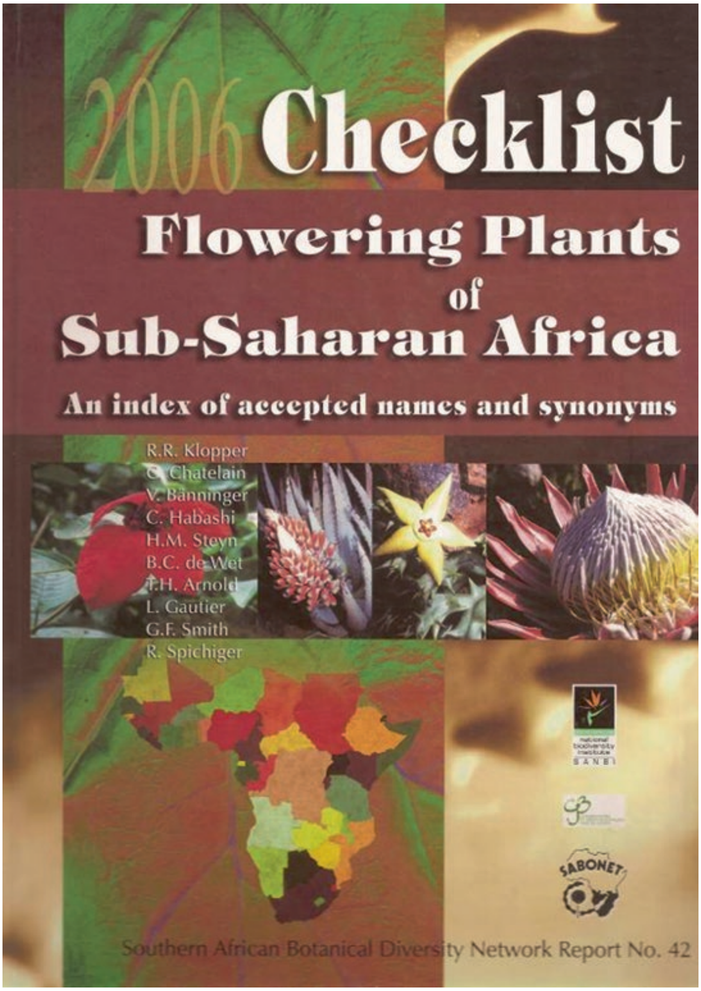

Fig. 6.7 Volume 42 of the SABONET Report series provided the first comprehensive checklist of the 50,136 species of sub-Saharan flowering plants. This listing formed the backbone of the African Plants Initiative. (Klopper et al. 2006b)

By 2017, at the conclusion of Mellon Foundation funding, the consortium of initiatives involved 329 partner herbaria worldwide, imaging and data-basing over 2.4 million herbarium sheets including nomenclatural types (‘type specimens’), historic and original material, and specimens of plants endemic to a single country. Following the model of the API, the GPI products are hosted by JSTOR, in Global Plants – the world’s largest database of digitised plant specimens and associated information. The investment by the Andrew W. Mellon Foundation in the suite of projects – (API, LAPI and GPI) – over 14 years of feverish activity, was several score million dollars, making possible unprecedented advances in the access to knowledge and training for botanists across Africa and beyond (Victor et al. 2016).

Unlike many multi-national projects funded by agencies such as GEF, UNDP, UNEP, etc., a formal and independent terminal review of the results and impact of the privately funded API and GPI has not been undertaken. The enormous value of the programme, however, is seen in the daily use of the digitised herbarium specimens by researchers around the globe. An early assessment was that of Nic Lughadha and Miller (2009) within a broader review of digitised botanical information. With reference to the API and GPI, these authors note: "Arguably the most significant innovation in electronic resources for botanists in the past decade has been the ability to capture, store and present high-quality images of the objects of interest, rather than simply recording the metadata relating to that object. This change, enabled by cheaper imaging technology, improved file compression standards, reduced storage costs and far-sighted funders has had a profound impact on the development and utility of botanical databases."

The evidence base is clear: the application of digitised herbarium resources has served to advance many fields of botanical research, functional ecology, climate change and biodiversity conservation in Latin America (Willis et al. 2003; Nic Lughadha and Miller 2009; Canteiro et al. 2019), Africa (Greve et al. 2016); and Australasia (Cantrill 2018).

6.6 Lesson Learned from the African Plants Initiative

In common with SABONET, the African Plants Initiative owed its success to a coincidence of many factors. These included:

- User demand for the product (from African taxonomists and conservationists needing easy access to information);
- Intellectual and institutional leadership (from Kew/SANBI/Mellon and the AETFAT membership);
- Innovation (the HerbScan device developed at Kew);
- An already tried and tested model for African collaboration (SABONET);
- Global policy incentives (CBD); and
- Generous, flexible and sustained funding (Andrew W. Mellon Foundation).

From the humble beginnings and tentative discussions of botanists in Maputo in February 1990, through the difficult and frustrating search for funding to establish SABONET, the experience gained in southern Africa stimulated a momentum that embraced similar initiatives around the globe. Plant taxonomists have overcome many of the serious impediments to their profession, and herbaria now serve a much wider spectrum of users in biodiversity conservation, environmental management and sustainable use of living resources. Herbaria and plant taxonomy have now entered the mainstream of modern approaches within the environmental sciences.

References

Canteiro C, Barcelos L, Filardi F et al (2019) Enhancement of conservation knowledge through increased access to botanical knowledge. Conserv Biol 33(3):523–533

Cantrill DJ (2018) The Australasian Virtual Herbarium: tracking data usage and benefits for biological collections. Appl Plant Sci 6:e1026

CBD (Convention on Biological Diversity) (2018) Global strategy for plant conservation. CBD, Montreal. Available from www.cbd.int/gspc/

Coleman CO (2015) Taxonomy in times of the taxonomic impediment – examples from the community of experts on amphipod crustaceans. J Crustac Biol 35(6):729–740

Figueiredo E, Smith GF (2008) Plants of Angola/Plantas de Angola, Strelitzia 22. South African National Biodiversity Institute, Pretoria

Figueiredo E, Smith GF (2010) The colonial legacy in African plant taxonomy. S Afr J Sci 106:3/4. https://doi.org/10.4102/sajs.v106i3/4.161

Germishuizen G, Meyer NL, Steenkamp Y, Keith M (eds) (2006) A checklist of South African plants, Southern African botanical diversity network report 41. South African National Biodiversity Institute, Pretoria. 1126 pp

Greve M, Lykke AM, Fagg CW et al (2016) Realising the potential of herbarium records for conservation biology. S Afr J Bot 105:317–323

Hoagland KE (1996) The taxonomic impediment and the convention on biodiversity. Assoc Syst Collect Newsl 24(5):61–62, 66–67

Huntley BJ (ed) (1994) Botanical diversity in southern Africa, Strelitzia 1. South African National Biodiversity Institute, Pretoria. 412 pp

Huntley BJ (2003) Overcoming the taxonomic impediment and leaping the digital divide: the SABONET experience in technology transfer. In: Sandlund OD, Schei PJ (eds) Proceedings of the Norway/UN conference on technology transfer and capacity building. Trondheim, 23–27 June 2003, pp 153–161

Huntley BJ, Matos EM, Aye TT et al (1998) Inventory, evaluation and monitoring of botanical diversity in southern Africa: a regional capacity and institution building network (SABONET), Southern African botanical diversity network report 4. SABONET, Pretoria. ISBN 1-919795-36-7

Huntley BJ, Siebert SJ, Steenkamp Y et al (2006) The achievements of the Southern African botanical diversity network (SABONET)—A southern African botanical capacity building project. In: Ghazanfar SH, Beentje H (eds) Taxonomy and ecology of African plants, their conservation and sustainable use. Proceedings of the XVIIth triannual congress of the AETFAT, Addis Ababa, Ethiopia. Royal Botanic Gardens, Richmond, pp 531–543

Klopper RR, Gautier L, Smith GF et al (2006a) Inventory of the African flora: a world first for the forgotten continent. S Afr J Sci 102:185–186

Klopper RR, Chatelain C, Bänninger V et al (2006b) Checklist of the flowering plants of Sub-Saharan Africa. An index of accepted names and synonyms, Southern African botanical diversity network report 42. SABONET, Pretoria. 892 pp

Mandela N (1994) Long walk to freedom. Little Brown & Co, Philadelphia. 630 pp

Nic Lughadha E, Miller C (2009) Accelerating global access to plant diversity information. Trends Plant Sci 14(11):622–628. https://doi.org/10.1016/j.tplants

Roux JP (2009) Synopsis of the Lycopodiophyta and Pteridophyta of Africa, Madagascar and Neighbouring Islands, Strelitzia 23. South African National Biodiversity Institute, Pretoria

Ryan D (2013) The global plants initiative celebrates its achievements and plans for the future. Taxon 62:417–418

Siebert SJ, Smith GF (2003) SABONET's support, activities and achievements in South Africa. S Afr J Sci 99:303–304

Siebert SJ, Smith GF (2004) Lessons learned from the SABONET project while building capacity to document the botanical diversity of southern Africa. Taxon 53:119–126. https://doi.org/10.2307/4135496

Simiyu S, Timberlake J (2005) Terminal review of the Southern African botanical diversity network (SABONET). GEF-UNDP, New York
Smith GF (2004) The African plants initiative: a big step for continental taxonomy. Taxon 53:1023–1025
Smith GF, Figueiredo E (2010) E-taxonomy: an affordable tool to fill the biodiversity knowledge gap. Biodivers Conserv 19:829–836
Smith GF, Roux JP, Raven P et al (2011) African herbaria support transformation on the continent. Ann Mo Bot Gard 98:272–276. https://doi.org/10.3417/2010050
Soltis PS (2017) Digitization of herbaria enables novel research. Am J Bot 104:1281–1284
Steenkamp Y, Smith GF (2002) Addressing the needs of users of botanical information, Southern African botanical diversity network report 15. SABONET, Pretoria. 56 pp
Steenkamp Y, Siebert SJ, Smith GF, Huntley BJ et al (2006) Final project report. Looking back on the SABONET project: a triumph of regional cooperation, Southern African botanical diversity network report 43. SABONET, Pretoria. 94 pp
Victor JE, Smith GF, Van Wyk AE (2016) History and drivers of plant taxonomy in South Africa. Phytotaxa 269(3):193–208. https://doi.org/10.11646/phytotaxa.269.3.3
Walters M, Smith GF, Crouch NR (2010) The African Plants Initiative (API) in South Africa. Taxon 59(6):1942–1948
Wheeler QD, Raven P, Wilson EO (2004) Taxonomy: impediment or expedient? Science 303:285
Willis F, Moat J, Paton A (2003) Defining a role for herbarium data in Red List assessments: a case study of *Plectranthus* from eastern and southern tropical Africa. Biodivers Conserv 12:1537–1552