

twas

Okavango Research Institute

MAUN, BOTSWANA

ORI



EXCELLENCE IN SCIENCE

*Profiles of Research Institutions  
in Developing Countries*

PUBLISHED  
IN COLLABORATION WITH

**SIG**

Science Initiative Group

Institute for Advanced Study

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## EXCELLENCE IN SCIENCE

### Profiles of Research Institutions in Developing Countries

Published by TWAS, the academy of sciences for the developing world

ICTP Campus, Strada Costiera 11, 34151 Trieste, Italy

tel: +39 040 2240327, fax: +39 040 224559

e-mail: [info@twas.org](mailto:info@twas.org), website: [www.twas.org](http://www.twas.org)

#### TWAS Executive Director

Romain Murenzi

#### TWAS Public Information Office

Daniel Schaffer, Gisela Isten, Tasia Asakawa, Cristina Serra

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# Foreword

For more than a decade, TWAS, the academy of sciences for the developing world, in collaboration with several other organizations and funding agencies – including the United Nations Development Programme’s Special Unit for South-South Cooperation (UNDP-SSC), the Global Environment Facility (GEF), the Packard Foundation and now its newest partner the Science Initiative Group (SIG) – has developed a large number of profiles of scientific institutions of excellence in the developing world. The profiles have been published as books (by Harvard University Press and Kluwer Academic Publishers), as articles (in Environment Magazine) and as news stories (in the TWAS Newsletter).

To date, more than 150 institutions have been examined. Each profile details how the institution has developed and how its research programmes are organized. Each explores the institution’s strengths, probes its weaknesses – and, most importantly – describes how its experience can offer valuable lessons for other institutions seeking to build scientific capacity.

A major goal of this decade-long initiative has been to showcase the high level of scientific excellence taking place in the developing world and to illustrate how science is being put to work to address critical social needs in the South. In this way, we hope that our expanding series of ‘best practices in the applications of science and technology’ can serve as a valuable blueprint for policy-makers and those involved in the administration and management of national policies and programmes.

The case study that follows – which examines the work of the Okavango Research Institute (ORI) – is about one such successful scientific institution in sub-Saharan Africa.

Dismal statistics abound about the state of science and society in sub-Saharan Africa, and numerous publications detail the difficult circumstances faced by the people of sub-Saharan Africa.

Yet, encouraging signs of progress are also emerging. Over the past decade, six of the world's 10 fastest growing economies have been in sub-Saharan Africa. These countries have been led by Angola, which has experienced an annual growth rate of more than 11%, and also include Nigeria, Ethiopia, Chad, Mozambique and Rwanda, each of which grew at an annual rate exceeding 8%.

Much of this economic growth has been commodity-based and due in no small measure to China's insatiable appetite for the continent's metals and minerals. While investments in science and technology have also grown, this growth has been at a far slower pace. Indeed, Rwanda is the only country in sub-Saharan Africa that spends more than 1% of its gross domestic product on science and technology.

Nevertheless, it would be wrong to ignore the increasing emphasis that countries throughout sub-Saharan Africa are placing on science and technology as primary engines of sustainable growth. The trend is discernible, in part, in the increasing number

of scientific institutions of excellence that are making significant contributions to their societies.

Investments, no doubt, remain too small, and the number of scientific institutions of excellence too few in number. Progress, moreover, has been uneven and fragile. And reversals in fortune are not uncommon. Moreover, the global economic crisis, which began in mid-2008, has placed the future at risk even for those African countries that have made significant strides. Yet, it should also be noted that many countries in sub-Saharan Africa have not only weathered the economic crisis better, but have also rebounded more quickly, than have the United States or the majority of countries in Europe.

In short, what has been happening in sub-Saharan Africa over the past decade is encouraging, and science and technology have become important tools in helping to advance these positive trends. TWAS and its partners are dedicated to exploring these developments by profiling scientific institutions of excellence that are leading the way for a better future on the continent – institutions like the Okavango Research Institute (ORI).

**Daniel Schaffer**

*TWAS Public Information Officer*

*Trieste, Italy*



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# Introduction and Issues



The Okavango Research Institute (ORI) is a unit of the University of Botswana (UB) located on the fringe of the Kalahari Desert in southern Africa, some 1,000 kilometres northwest of UB's main campus in the capital city of Gaborone. It is dedicated to the study and conservation of one of the world's largest and most intact inland wetland ecosystems: the Okavango Delta. In 2010, ORI's area of concern expanded to the entire Okavango Basin in which the delta resides. That area adjoins Zimbabwe to the east, Zambia and Angola to the north, and a sliver of Namibia along the northern frontier. The institute, which was not fully staffed until the mid-1990s, has grown rapidly in the past several years.

Additional growth is anticipated with the opening of a second UB campus adjacent to the site of ORI. Construction is scheduled to take place no later than 2015. The entire complex is about 15 kilometres up the Thamalakane River from the sprawling, dusty town of Maun, the destination for most tourists who travel from around the world to see the Okavango's rich wildlife.

ORI remains physically small. There's only one main building for offices and laboratories, plus a handful of outlying, mostly temporary structures for graduate students, visitors and staff. It also has a tented camp to accommodate visiting students and researchers, a refurbished library, a new herbarium and a modern geographic information systems (GIS) laboratory, which produces maps and charts and maintains geospatial data on the Okavango Basin.

#### THE OKAVANGO RESEARCH INSTITUTE (ORI)

- *Private Bag 285 - Maun, Botswana*
- *tel: +267 686 1833*
- *fax: +267 686 1835*
- *e-mail: [dirorc@orc.ub.bw](mailto:dirorc@orc.ub.bw)*
- *website: [www.orc.ub.bw](http://www.orc.ub.bw)*

With 33 academic staff and 45 support staff, ORI is involved in more than 25 research projects, many in collaboration with international partners. The institute's mandate extends beyond hydrology and natural resource management to issues related to ecosystems, tourism, livelihoods and governance.

ORI's educational functions are new and growing. The first graduate students arrived in 2009. Currently, 15 students are enrolled, five of whom are supported by the Regional Initiative in Science and Education (RISE), a programme funded by Carnegie Corporation of New York and administered by the Science Initiative Group (SIG) based at the Institute for Advanced Study in Princeton, New Jersey, USA.

About 20 undergraduates attend a course in research methods that takes place during the main campus's summer break. They work with mentors on small, basic research projects. A master degree's programme in development practice will begin in 2011 to train students from around the world on strategies for establishing businesses in developing countries. This programme has received funding from the MacArthur Foundation and grants from the University of Florida in the US. In the near future, however, ORI plans to continue to focus largely on research, with grants from external funding agencies providing much of its income.



*With 33 academic staff and 45 support staff,  
ORI is involved in more than 25 research projects,  
many in collaboration with international partners.*

# Recent History

Until recently, ORI was a little-known scientific institution tucked away on the northern edge of the Kalahari Desert in Botswana. Today, thanks to the reach of the internet and the ease of modern travel, ORI has moved to the forefront of research and academic excellence. Indeed it is showing signs of regional leadership.

ORI's primary mission is to explore and understand the wetlands and hydrology of the Okavango Delta. It also seeks to link its scientific objectives to the needs of the communities that surround it. Indeed what has set ORI apart from many research institutes is its focus on outreach. As Susan Ringrose, ORI's director, notes: "We need to do sound research. We won't receive funding without it. But we need to do relevant research too."





We can't just sit in our ivory towers and expect support from the government and citizenry without feeding our work back to the country.”

ORI launched a graduate training programme in 2009, adding education to its broad mandate for research and community service. The academic staff consists of natural scientists who work closely with social scientists, focusing their studies on the intricate relationship between people and the environment. The University of Botswana (UB), located in Gaborone, provides staff support and plays an important role in covering overhead costs for personnel and day-to-day operations. However, ORI is now responsible for raising virtually all of its research funding. It does this largely through external funding, some of which takes place within a framework of international partnerships.

ORI's transformation from a centre dedicated to basic scientific research to an organization focusing on socially relevant issues has been a gradual process, sometimes punctuated by decisions that have prompted rapid change. For example, UB's strategic plan, published in 2009, reiterated several themes that have become increasingly prominent at ORI: the need to pursue research excellence, the importance of attracting outside funding, and the necessity of putting science to work to address critical societal challenges.

By calling on ORI to contribute to science-based development in the region, UB's strategic plan, in effect, has prompted ORI to accelerate this process. For ORI's leadership, the institute's broader responsibilities now not only include the need to strengthen

the institution's scientific knowledge base, but also to use this knowledge to benefit the broader community to which ORI belongs – and from which it receives its core funding.

Wellington Masamba, deputy director for research services who arrived in 2003 and who was instrumental in encouraging ORI to move in this new direction, explains: “Somewhere along the line ORI had become too academic. A few years ago we began to survey our stakeholders – government officials, farmers, fishers and tourist operators – asking them what they expected of us. The findings clearly indicated that we were not serving them well. The farmers, in particular, said that the information we were generating was of little practical value to them. As a national institute, we have to give back – both to society and to government. We are not unique in this regard. I don't think many institutes in Africa have the luxury to just study without giving back.”

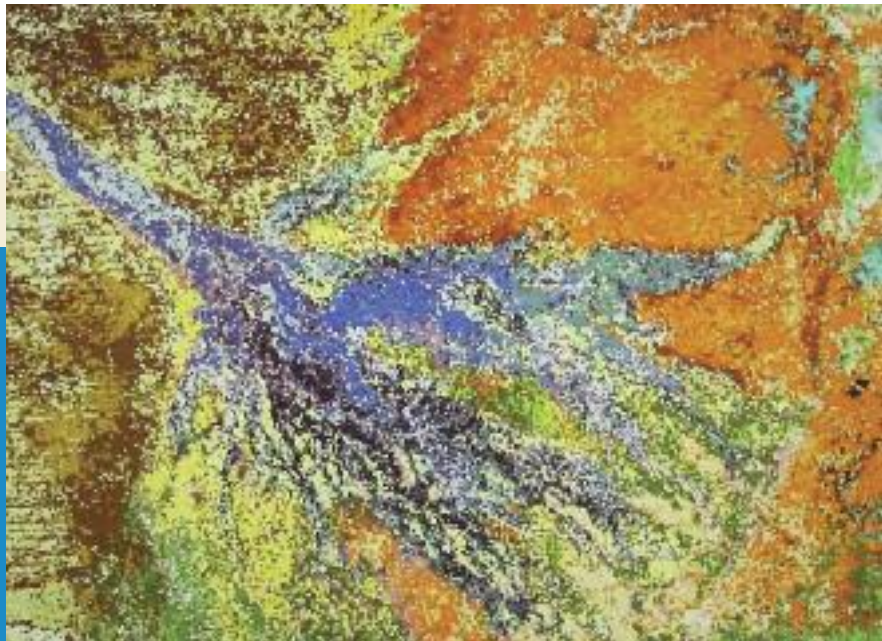
Lapologang Magole, who was appointed head of planning and marketing during the reorganization, agrees: “Following the recommendations of the 2009 strategic plan, we have reorganized ourselves. The goal is not only to do higher quality research, but also to do more effective outreach. We organize community meetings, we talk on the radio, and we go out there and interact with people. We meet with tourism operators, cattle herders, fishers, traditional healers and government officials – all as part of a larger effort to gain a better understanding of how we can help them achieve their goals. We have completely reversed the way we operate. We don't dream up ideas in our laboratories. Instead, we receive research ideas from our stakeholders.”

*We need to do sound research,  
but we need to do relevant research too.*



# Delta Issues

**O**RI sits near the banks of the Thamalakane River in a dry forest of mopane trees. The slow-moving, often languid, river is one of the drainage fingers of the Okavango Delta. Each year, summer rainfall pelting the southern Angola highlands swells the Okavango River and its tributaries. Yet the river seldom experiences serious flooding. Indeed it rarely overflows its banks. More often than not, the water seeps into one of the world's largest inland deltas at a pace that helps define this lush ecosystem teeming with biodiversity. The Okavango Delta supports large populations of wildlife that attract tourists from around the world, thus playing a crucial role in the local economy.



## Desert water

Much of Botswana is part of the vast Kalahari Desert, where chronic water shortages pose a major challenge. To address this challenge, the government proposed the Southern Okavango Integrated Development Plan (1985-1989) to retain and store Okavango's precious water supplies by dredging the delta and building a series of dams.

Few people around Maun gave the plan much credence until the heavy equipment began to arrive. This had long been a remote area where nature ruled and where government was defined more by its absence than its presence.

"Suddenly, it was all systems go," Masamba notes. "People opened their eyes and saw the bulldozers and earth-moving machines." The reaction was neither accepting nor passive. "There was a local uproar and an international furor," says Masamba.

The plan, in fact, was halted, partly through the action of the Kalahari Conservation Society, which emphasized the need to gather more scientific information about the effects of impeding water flow in the delta. The society then marshalled support from other organizations that held similar views. In the early 1990s, the government bowed to the concerns and offered an alternative plan that emphasized the need for additional and ongoing study.



*The Okavango Research Institute sits near the banks of the Thamalakane River in a dry forest of mopane trees.*

## PETE SMITH'S LEGACY

• After partially completing an accounting degree at Rhodes University, in South Africa, in 1956 a footloose Rhodesian named Pete Smith journeyed to Botswana (or, as it was then called, Bechuanaland). He subsequently moved to Maun in 1959, where he found work at Riley's Garage, which is still in operation today. He went on to a number of positions, first as a tsetse fly control officer in the 1960s, then as an ecologist at the Department of Agriculture in the 1970s, and finally as a hydrologist at the Department of Water Affairs in the 1980s. Entirely self-taught, he gained unparalleled knowledge of delta ecosystems – and a deep love of the Okavango Delta itself.

Often alone and never armed, dressed more like an accountant than an adventurer, Pete Smith explored by boat and dugout canoe every cranny of the delta, surviving mostly on ginger nuts, condensed milk and tea. He carried a tin trunk of books and 1:50,000 scale maps on which he made annotations about the local names of settlements, water depths, new botanical finds and his own meandering routes. A founding member of the Kalahari Conservation Society, his knowledge equipped him to inform the public about environmental concerns when the new Botswana government began to propose water extraction and diversion schemes as early as the 1970s, and more seriously in the 1980s.

Smith died in 1999. The ORI library has digitized his maps, which provide unique baseline data about environmental conditions of the delta. His collection of plant specimens accounts for some 5,000 of the 13,000 species in ORI's new herbarium, and his large collection of books forms part of the new ORI library. A self-effacing man, Smith left few writings about his personal experiences or opinions. A tribute posted on the wall of the ORI library comments that "if he had a weakness, it came from a modesty which often inhibited his communications about his findings."



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The new plan called for the construction of a Maun Field Station. The station, which was not completed until five years later, consisted of a laboratory, two small dormitories, a storeroom and a small ablutions block. There was no furniture, equipment or staff, except for a single caretaker.

Not surprisingly, this half-hearted measure did not assuage the critics. The facility, Masamba observes, was ultimately deemed “below the minimum threshold required for effective operation.”

Events continued to proceed slowly. In 1987, a small expansion took place, but funding for operations remained stagnant. Finally, in 1991, a report funded by the British High Commission recommended the establishment of a full-fledged Okavango Research Centre, to be operated by UB, for the “conservation and advancement of scientific knowledge of the Okavango delta and ecosystem.”

Early on, the centre focused on the hydrology of the delta, which was still poorly understood. After the plan initially outlined in the commission report was approved in 1993, UB appointed Lars Ramberg as ORI's first director. Ramberg, an expert in freshwater systems from Sweden, arrived in 1994. As expected, he developed a research agenda concentrating on hydrology, biology and social development.



Thanks largely to the efforts of Peter Smith, a self-taught botanist and conservationist (see box, p. 18), a great deal was already known about plant taxonomy in the region. Yet little information about the topic had been published. As a result, one of the first orders of business for the centre was to make existing information available to as large an audience as possible, reaching out to schools, community leaders, and visiting scholars.

In 1995, the centre's mission was expanded to include the "cultural, social, economic, and environmental problems of the Okavango region," which is "among the poorest areas in Botswana, yet contains some of the nation's most precious natural resources." This broadened the centre's mandate from simply acquiring and distributing knowledge to applying it.

## DAM PROBLEMS

• *Although there are no present threats to the free flow of the Okavango River, the prospect of upstream dams is a continual worry for ORI biologists. The source of the delta's fertility – which now attracts huge populations of wildlife and supports a broad diversity of plant life in the delta – are the floods themselves. Each time they come, the amount of dissolved organic matter more than triples as the water rises into the decayed vegetation from the previous year, liberating its nutrients. Dams that release a steady, year-round flow of water would eliminate this flooding, confining the delta flow to permanent channels and swamps that are low in dissolved organic carbon and support little biodiversity. "Seasonal flood plains become productive grazing areas after the rains," says Michael Murray-Hudson, a research scholar at ORI. "The dissolved nutrients fuel microbial populations and biological productivity at every level, up to the herbivores and predators."*



## S N A P S H O T



## Down under

Trying to understand the science that shapes the intricately layered ecosystem of the Okavango Delta is no easy task. The delta is part of the Okavango Basin, the southwestern extension of the East African Rift that encompasses parts of Zambia, Zimbabwe, Namibia and Angola.

The basin is more than 700,000 square kilometres in size. Its surface consists of thin, fan-like alluvial deposits and salt pans. Beneath the surface lies a thick blanket of sandy sediment. The sediment, in turn, rests on a volcanic base.

The annual “pulse” of floodwater, originating in the highlands of Angola, creates a delta environment rich in organic matter. Indeed, yearly floods nourish a diversity of ecosystems: languid lagoons, reed- and papyrus-filled swamps, spongy grasslands, and temperate riverine and dry woodlands.

The ecosystem supports a treasure trove of organisms that include some 1,300 species of plants, 70 species of fishes, 30 species of amphibians, 65 species of reptiles, 445 species of birds and 120 species of mammals, including the “Big 5” – lion, elephant, buffalo, leopard and rhinoceros. As the floodwaters recede, the region’s farmers benefit from the bounty of nutrient-rich resources that are left behind. Botswana’s delta farmers plant and harvest a cornucopia of crops in the wet soil, just as farmers along the Nile have done for thousands of years.

# Delta mysteries

The delta's water not only nourishes life; it also spawns mysteries. Even today, many observers do not understand where the annual floodwaters go. One tourist-oriented website asks: "Where else on the surface of the earth would you see a mighty river just disappear underground?"

In truth, only about 2% of the water flowing into the delta or falling as rain replenishes the groundwater. Most of the water either evaporates or is transpired by trees and other plants.

Indeed transpiration explains another of the delta's mysteries: How is that the Okavango River can remain pristine and virtually salt-free even though whitish saltpans, left behind as the water evaporates, dot much of the arid landscape of southern Africa?

The answer lies in transpiration. As the trees "pump" the water upward through their roots and skyward through their leaves, they pull it toward the surface, leaving salts and other minerals behind in the subsoil.



*The delta's water not only nourishes life;  
it also spawns mysteries.*

## SUSAN RINGROSE, Director of ORI



• **Susan Ringrose**, director of ORI, began working and teaching at the Main Campus of the University of Botswana in 1983. She came to Botswana with a PhD degree in remote sensing, soil science and Quaternary geology and was tasked with helping the country combat drought and desertification. After a period as a project leader in the National Institute of Research in Gaborone, she was transferred to Maun in 2000 and in 2003 became head of the newly formed Land and Water Unit of ORI. During her decade in Maun, she has been a productive researcher specializing in geomorphology and biogeography – how landscapes form and change – and has pioneered the application of remote sensing techniques to vegetation mapping in semi-arid countries. One of her specific interests involves the formation of soils and, in particular, duricrusts – thin, hard layers of minerals deposited at the soil surface in arid settings that experience rapid evaporation. Another aspect of her work is to examine landscape change, focusing on areas subject to broad-scale wetting and drying – basically considering the effects of floods and droughts on landscape and in particular soil processes. A native of the UK, she has acquired broad knowledge and expertise in these areas since moving to southern Africa, and has published more than 80 papers in peer-reviewed publications. While Ringrose continues her research with many colleagues, her duties have grown with the rapid evolution of the ORI. As director, she is responsible for ORI's overall management, and especially for co-ordination and implementing the strategic plan emphasizing community interactions, which has become a central focus for ORI as it moves to full institute status with expanded research and teaching responsibilities. "We receive very good support from the university," she said. "It pays for 90% of staff salaries, and for most of our vehicles, utilities, and instrumentation. But there is less public money coming into the university overall, so we are being urged to be more self-sufficient." She is also tasked with helping organize the University of Botswana's new Maun campus, scheduled to begin activities in 2015. She expresses pride in having achieved Botswana citizenship in 2009, which strengthens her own relationship to the community. She is also proud of the fact that most of her young faculty are Botswanans who are active researchers and can communicate easily with the delta people living nearby.



# Rich Environment, Poor People

Although the region has enjoyed continuous settlement since the Stone Age, not a great deal is known about the history of the people who live there. Many are related to the San, or bushmen, of the Kalahari; others descend from migrants from southern Africa. Today, the people of the delta mainly occupy the periphery where they use the land for farming, grazing, reed and firewood gathering, and fishing. Considerable attempts are being made to employ the residents in the tourism industry. However, the unemployment rate in Ngamiland District, which includes the delta, stands at 64%, the illiteracy rate at 35%, HIV infection is high, and more than 80% of households live below the poverty line. The government is seeking to address all of these issues.



Thus while the biota of the delta is rich and the water pristine, the tribal people who depend on the region's resources for their sustenance and livelihoods remain poor. Although the local people technically own the land – some 95% of the area of the delta is held in trust under Botswana's Tribal Land Tenure System – they have benefited little from the natural wealth that has been a mainstay of the ecosystem for eons.

## Research for people

To help improve living conditions among the local population, ORI researchers have sought to link their research to issues of importance to the people who live there and to the policies of the public agencies that are mandated to help the people.

As Piotr Wolski, an ORI hydrologist, says: “We are trying to bring an understanding of biodiversity to the people. We take local officials to sites in the delta, show them how we are monitoring the ecosystem, and explain how the natural environment benefits them and the people they serve. We speak about how climate change is likely to have negative effects on their lives and how they might be able to adapt to these challenges.”

Wolski has devoted the past two years to studying climate variability, using mathematical models both to forecast trends and visualize how these trends will impact the community. For example, the ORI website, which he helped to design, includes real-time rainfall data. “We have people out there measuring precipitation,” he says, “and we make our forecasts widely available. Last April we anticipated that a big flood was coming, and we warned people about it. Our prediction proved accurate. It turned out to be the second biggest flood since record keeping began in 1923.”

In the past, the public rarely received such information and therefore was ill-prepared to respond to a potential natural event or hazard. Now, however, Wolski is receiving

*While the biota of the delta is rich and the water pristine, the tribal people who depend on the region's resources for their sustenance and livelihoods remain poor.*

## ON FIRE

- *With so many people competing for the Okavango Delta's rich but limited resources, conflicts are inevitable. One example involves the uses of fire. It is practically impossible to fly over Ngamiland at night without seeing fires. Virtually all of the fires are supported by some people and opposed by others, depending on the location and time of year.*

*Hunters want to use fires to flush out game, but their fires often spread. Fishermen want to burn old vegetation just before the floods, thinking they will catch more fish and clear the snags. Owners of tourism sites burn selected portions of their lease holdings where fresh green grass will attract wildlife. Thatchers don't want fires until the reeds are strong and tall enough for harvest. Cattle owners may want fires just before it rains to allow new vegetation to sprout, but after that they don't want fires. Small farmers want to clear their fields with fire before planting – but they don't want fires to consume the firewood that they need for cooking and for heating their huts in the chilly winters.*



## S N A P S H O T

continuous queries about future predictions. “Farmers need to know where and when to plant their crops, tour operators need to know whether and when they can work, government officials need to know if they can deliver services. For example, for two or three months last year no mobile health clinics could get out to the communities because of the floods.”

As predictions continue to improve and to reach those who most need this information, ORI hopes to be able to help people adequately prepare for the risks and impacts of the natural hazards they face.

## BioKavango: Reaching the people

*BioKavango*, which combined scientific research with public outreach, has been one of ORI's most successful programmes. The five-year programme, which ended in December 2010, had four components: tourism, fisheries, water and biodiversity mainstreaming (that is, teaching people about the value of biodiversity for tourism and other aspects of economic development).

Each of these issues involved a degree of conflict in the community, often fuelled by an insufficient knowledge of the factors that determine long-term health and sustainability.

*BioKavango* sought to minimize community conflict. "One way we hoped to do this was to dispel some misperceptions, including the one that fishers were overfishing certain areas," says Lapo Magole, an ORI social scientist who is charged with expanding the ORI donor base and strengthening its outreach efforts.



"We showed this wasn't true – that, in fact, the scale of the fishing industry in the region was simply too small to overfish the stocks. Instead, the real source of discontent turned out to be that the tourists simply did not want to see local people fishing in front of their lodge. The problem, in short, was one of expectations and perception, not reality."

Another misperception Magole cites was that an invasive plant from Brazil, *Salvinium molesta*, would permanently choke off the waterways and kill the fish. "We worked with the Botswana Department of Water Affairs," she says, "importing a tiny weevil that is helping to control this plant." As a result of this effort, the problem has now been abated.

*The Okavango Delta Management Plan, which was compiled by ORI, has set the course for many environmental projects.*

A third misperception Magole points to was that cattle were grazing on land that had been reserved for tourists, interfering with the wildlife that tourists had come to see. “We showed that was seldom the case. We also showed that when trespassing did take place, it was because the cattle herders believed the land belonged to them.”

Addressing the issue involved conducting research to help ensure that the discussions would be based on facts, not feelings. It also involved bringing the parties together to make it possible for them to work out their differ-

ences – or, at least, create a forum where there was the potential for conflicts to be resolved. As Magole notes, “we had to encourage people who were at odds to talk with one another. And we had to bring science to the table to help ensure that we were perceived as objective and not taking sides.”

Specifically, ORI staff arranged for community leaders, government officials, fishers and tourism operators to meet and discuss issues of common concern over which conflicts had flared.

Tourism operators balked at first. But they soon realized they had to participate if they were to have any chance of resolving the critical problems they faced. The discussion, in fact, led several community leaders to join together in setting up their own tourism operations, such as the Tubu Village Tourism Company. The goal was to construct a cultural village featuring ancient rock paintings and to operate a campground to attract tourists.



ORI also worked with government officials to require both cattle herders and tourism operators to file environmental management plans when leasing land. Because virtually all of Okavango's land is held in trust for local tribes, all land users must lease rather than buy land for private use. This allows the government to include incentives for good management practices.

To continue the work of *BioKavango*, assistant librarian Olebo Suwe and others plan to post slides of *San* culture and dances on the ORI website and display posters of these cultural activities in the Maun town centre.

"Tourists are interested in the *San*," she says. "They heard about them but don't know much about how they live and would like to learn more. Our efforts are designed to help enrich their experience."

*BioKavango* evolved from an earlier successful effort to draw up an Okavango Delta Management Plan (ODMP), which was compiled by ORI, government, the community and other stakeholders. The plan, which is an official government document, has set the course for many environmental projects. Its recommendations were carefully designed and implemented with the help of tribal chiefs.

In particular, notes Magole, ORI was careful to present and discuss its ideas publicly at the *kgotla* meetings – traditional forums where all attendees can speak freely on any topic without fear of ridicule or reprisal. The authority of the *kgotla* rests with the local chiefs who oversee and mediate all discussions.



# Fenced out

ORI has also found itself in the middle of a contentious issue frequently encountered not just in the region but also in large parts of southern and eastern Africa: the use of wildlife fences to separate disease-bearing wildlife from domestic cattle. A series of fences, some hundreds of kilometres long, are draped across the delta, blocking the movement of large animals.



European countries mandated the construction of the first fence, built just south of the delta in 1982, when foot and mouth disease was discovered among wild ungulates. Beef importers in Europe feared the disease would spread to cattle and then to their countries – even though there were few confirmed cases.

The remedy, in fact, had a more detrimental impact than the problem itself. Impediments to the movement of wildlife led to a crash in population of some

species. The number of wildebeest, for example, fell from some 300,000 in the 1950s to about 10,000 today. The same troubling trends affect hartebeest and zebra.

“Large mammals must be able to move from one range to another depending upon the season,” says Caspar Bonyongo, a wildlife ecologist at ORI. “Historically, in the Kalahari, animals migrated from eastern Botswana to Okavango, a distance of more than 200 kilometres. But the fences have now impeded their migration. Wildlife in Kruger National Park in South Africa faces a similar problem. Migrating in search of water, animals come up against the fences and die. In this respect, most of the national parks in Africa are dysfunctional. Institutes like ORI need to present research findings about these events in terms that policy-makers can appreciate and act on.”

## MOSES CHIMBARI, Deputy Director for Research Management



- **Moses Chimbari** is deputy director for research management with a central interest in public health. Before joining the University of Botswana in February 2008, he was director of research and innovation (2007-2008) at the National University of Science and Technology in his native Zimbabwe and scientific director (2006-2007) at University Lake Kariba Research Station (ULKRS), a research institute at the University of Zimbabwe.

He has a PhD in snail ecology with special interests in research on vector-borne diseases. Much of his work has been on schistosomiasis and malaria, and to a lesser extent on HIV/AIDS. He was the national leader of the Zimbabwean System-Wide Initiative on Malaria (SIMA) team that conducted a project funded by Canada's International Development Research Centre (CIDRC) on eco-health approaches to prevent and control malaria in wetlands in Zimbabwe.

At ORI, Chimbari is seeking to forge stronger links with both Southern and Northern partners and expand the institute's outreach to the community. One of his major responsibilities will be managing the large IDRC-funded EcoHealth programme that will support 10 to 15 scientists from different institutions, disciplines, and countries. At the same time, he continues to reach out to colleagues and students at every level. Recent efforts include a programme to bring high school students to ORI to witness research first hand and talk with working scientists. "I got the idea when I was at Johns Hopkins University in the US in 2005 on a Fulbright scholarship," he said. "They had high school kids there, and I could see how much it meant to them to come into the laboratories. We need to reach out to find the scientists of tomorrow."

*ORI faculty devote more than half of their time to research and classroom teaching. The rest is spent on providing community services.*



## Science and tourism

While it may be rare for a scientific research institute to study tourism, the topic is unavoidable in a place like Maun, which attracts virtually all of the tourists who come to Botswana.

Indeed ORI studies tourism in the same way that it studies hydrological or botanical questions. The institute is intent on gathering and analysing data, conducting surveys, engaging stakeholders and providing fact-based information that can serve as the basis of effective policy-making.

“We examine everything, starting with cost-benefit analysis,” says Joseph Mbaiwa, who earned his doctorate degree in Parks and Recreation Science from Texas A&M University in the US. “Tourism provides jobs, but it carries costs too. For example, the elephants that tourists come to see also damage crops. Lions eat cattle and goats, increasing risks to local food supplies.”



*ORI studies tourism in the same way that it studies hydrological or botanical questions.*



ORI faculty devote more than half of their time to research and classroom teaching. The rest is spent on providing community services.

ORI staff, for instance, have worked as consultants to the government. “In late 2009,” says Mbaiwa, we completed a plan on how the three countries bordering the Okavango Basin – Angola, Namibia and Botswana – can improve their management of the region, especially at the community level. We spoke with a wide range of people, helping them to gain the skills they need to prepare contracts and, more generally, to devise effective strategies to improve employment conditions.”

ORI staff have also worked with the Tourism and Hospitality Association of Botswana to settle disputes through joint management committees. As a result of the work of these committees, cattle herders have been granted access to fenced areas under dispute and fishers have agreed not to use nets that catch fish below market size.

“We are making progress,” says Mbaiwa. “We don’t always say or write things that all parties like. For example, we determined that the tourist lodges were not disposing of waste properly. They didn’t like that, but we have to make our recommendations and keep our integrity intact by serving as honest brokers. Over the long run, it is in everyone’s interests that we behave in this manner.”

More recently Mbaiwa led a comprehensive research initiative examining whether tourism could be effectively used as a tool for conservation. The initiative showed that tourism could indeed serve this purpose even as it provided more immediate economic benefits. This would be especially true if strategies to expand tourism were incorporated

## WELLINGTON MASAMBA, Deputy Director for Research Services

- **Wellington Masamba**, deputy director for research services, came to ORI from his native Malawi in 2003, where he taught chemistry at the University of Malawi. He earned his doctorate degree in chemistry at the University of Florida in the US. After postdoctoral studies at George Washington University, also in the US, he returned to southern Africa to teach at the University of Malawi.



Like almost all faculty researchers at ORI, Masamba's research interest involves water – in his case, the distribution, chemistry and quality of groundwater, a vital resource for arid land. Virtually all the surface water of Botswana is located at its borders, forcing most of the population to rely on boreholes sunk into the sands. "Almost all of this water is salty," said Masamba, "and the quality gets worse as you move away from the Okavango. So you have to desalinate it before it's drinkable." Masamba notes that ORI scientists have always done water research, but it was not planned strategically or organized by topics useful to policy-makers. Even water quality and water flow were not monitored systematically until 2008, despite sharp fluctuations in both. The water flow at Maun Bridge, for example, was 50% higher in 2010 than the year before. In 2003, when Masamba arrived, it was almost zero, as severe drought gripped the Okavango. "I almost turned around and went back to Malawi," he recalls.

*Challenges remain stubbornly in place.  
But conflicts and controversies that stood  
in the way of progress have been overcome.*



into community-based resource management schemes. “Tourism can be a very effective tool when the community is organized, social capital is high, and networks are actively engaged,” says Mbaiwa. “Success, of course, depends on whether the various parties can reach a consensus on how to move forward.”

Mbaiwa cites this example. “Ranchers and tour operators,” he notes, “have fought a great deal over the fences that have been built to contain buffalo that roam the area. To help resolve this conflict, we asked representatives from both groups to join a committee dedicated to discussing how this issue could be overcome in ways that would address their concerns. The solution lay in allowing cattle herders limited access to the community areas that would continue to be used primarily for tourism.”



Fishers were also asked to be on the committee. An agreement was reached that certain kinds of low-impact fishnets could be used on the waterways inside the community areas. Fishers could continue to fish but only under conditions that would not undermine the tourist trade.

“Challenges,” Mbaiwa readily admits, “remain stubbornly in place. But conflicts and controversies that stood in the way of progress have been overcome.” He also adds that: “The willingness of the various parties to speak to one another and the success they have achieved as a result bodes well for the future.”

## TOMORROW'S RISING RESEARCH STARS

• **Siziba Nqobizitha**, who was born and raised in Zimbabwe, earned his master's degree at the National University of Science and Technology in Bulawayo. He specializes in aquatic ecology. While working as a research assistant at Lake Kariba Research Station, he met the director, Moses Chimbari, who soon left for ORI and invited him to come along. With the help of RISE, Siziba completed his PhD, which showed the integrity of the delta's ecosystem had been placed at risk by climate change and increasing demand for water. He plans to continue exploring how climate change will affect both the quantity and quality of water resources in the region.

• **Gaolathe Tsheboeng**, who hails from Gaborone, Botswana's capital, learned about RISE just as he was completing his bachelor's degree at the University of Botswana. His research at ORI focuses on the intricate relationship between annual flooding, vegetation and animals in the delta. Flooding is necessary to preserve the natural richness of the delta and its biota, Tsheboeng says. He fears that major hydrologic changes designed to reduce flooding – most notably, the construction of dams upstream, which Angola has long contemplated – would reduce the ecosystem's rich plant and animal biodiversity.



## S N A P S H O T



- **Kelebogile “Kelly” Cole** has always wondered how different forms of life could survive in southern Africa’s harsh, dry climate. Since earning a degree in ecological studies from the University of Botswana in her home town Gaborone, Kelly, with RISE support, has worked at ORI, studying the effects of the flooding on soil nutrients. In the near future, she hopes to secure additional support to pursue a doctorate degree that she will need for a career in academia.

- **Kondja Amutenya** came to ORI as a master’s degree student from the National Marine Institute Research Center, in Swakopmund, Namibia, where he learned about fisheries. His research, supported by RISE, sought to shed light on a puzzling size difference between tilapias of the same age from the northern and southern delta. His hypothesis: Southern fish, which depend on the temporary seasonal flood water to grow and mature, must do so rapidly, whereas northern fish, which live in permanent flood channels, have more time to mature. In the future, Kondja hopes to study the effects of diamond mining on groundwater quality in his native Namibia.

## S N A P S H O T

*We can offer an exciting work environment  
for young researchers.*

# International Efforts

ORI faculty are also reaching out internationally – for external grants, for partnerships and collaboration, for students and for recognition. The institute, in fact, has forged partnerships with universities in Europe and the US. It also serves as the host of the Africa Climate Change Network. Other projects include:

- *The Okavango River Basin Commission (OKACOM)*: ORI seeks to advise this three-country commission, comprising representatives from Angola, Botswana and Namibia. The commission, whose secretariat is in Maun, is responsible for co-managing the Okavango watershed. Namibia currently has urgent water needs, and, if current



trends continue, Angola will certainly have them in the future. ORI's strategy will focus on nurturing collaboration between Botswana and its neighbours while, at the same time, making every effort to preserve the water quality of the delta.



- *EduLink*: This EU-funded programme, which ORI manages, is designed to raise the quality of research proposals. There is a similar institute at the University of Zimbabwe, the University Lake Kariba Research Station, where Moses Chimbari, ORI's deputy director for research management, worked before coming to Maun. "We realized that one of the biggest weaknesses in Africa's academic community is not knowing how to obtain funding," says Chimbari. "When the call from the EU came, I wrote to EduLink and told them we needed training on how to develop a proposal. We initially focused our efforts on our senior faculty," he explains. "We then expanded our operations to train 20 faculty in Sudan. Now we are thinking about enlarging our efforts at ORI." The goal is to identify research topics that are original, testable and innovative. "Everything we do," Chimbari explains, "must be budget-worthy: What will be the personnel costs? How much will the laboratory and field work cost? What will we have to spend for office space and housing? For four-wheel-drive vehicles?"



## ORI'S MAIN FUNDERS

• ORI has many funding and research partners that include Canada's International Development Research Centre (IDRC), the German Federal Ministry of Education and Research (BMBF), the UK's Department for International Development (DFID), the UN's Environmental Protection and Sustainable Management of the Okavango River Basin (EPSMO), the US National Science Foundation (NSF), the European Union (EU), the Global Environmental Fund (GEF) and the Volkswagen Foundation. Most of the faculty collaborate with universities abroad, including the University of Florida, University of Virginia, University of California at Los Angeles (UCLA), Ohio State University, University College-London, University of Rennes, University of Bergen, and University of Namibia.



## S N A P S H O T

- *EcoHealth*: This USD600,000 initiative, funded by Canada's International Development Research Center (IDRC), is a five-year, multi-disciplinary study of public health in local villages. It involves some 12 scientists working in a broad range of related fields, including nutrition, agriculture, anthropology, biodiversity and land use. The goal is to place public health at the centre of the development process, and to examine the multiple factors that determine good health and add to the citizenry's well-being and productivity. The project will focus on three villages. Work teams will be made up of staff and graduate students whose efforts will be guided by discussions with stakeholders and community advisory boards. "This approach will help insure that our interventions are demand-driven and involve both experts and local people.

- *The Future Okavango (TFO)*: This five-year project, sponsored by the German Federal Ministry of Education and Research (BMBF) and launched in 2010, will examine the vital role that ecosystem services play in the larger economic system as determined by the ability of natural systems to generate clean water, healthy air and fertile soil. A variety of studies will examine such broad areas of interest as hydrology and climate change in the Okavango Basin. The studies will concentrate, in part, on how people interact with their environment to improve their health and social and economic well-being – for instance, by relying on indigenous plants for their pharmaceuticals and on the region's unique flora and fauna to attract tourists.



*The goal is to identify research topics that are original, testable, and innovative.*

# Science: Natural and Social

ORI seeks to meld the research of natural and social scientists by pursuing projects that rely on data and information from a wide variety of disciplines.

“It’s rare to find an institute where both natural and social scientists are working together in such a truly interdisciplinary way,” says Barbara Ngwenya, a social scientist who arrived at the institute in 2002 with a doctorate degree in social work and a specialty in community practice that she had earned at the University of Michigan in the US.

“I work closely with Keta Mosepele, a fish biologist, and also with Donald Kgathi, an economist,” Ngwenya notes. Researchers at ORI reach out not only to colleagues in other disciplines but also to local people, both to acquire information and gain insights and





understanding from their experience on the ground and from dealing with real-life situations. “We view the local people as partners,” she says.

“For example, when it comes to practical knowledge, fishers know more about the delta than most scientists do – where to fish, when to fish and when the floods will come. I speak with fishers infected with HIV, with women at high risk of contracting the disease, and with traditional healers to find out what medicines they use to treat HIV. I gain their trust, ask them how they prepare their plants and get them to work with university-trained health practitioners at the clinics.”

In a similar fashion, Ngwenya collaborated with ethnobotanists to learn about indigenous plants. At the same time that she was interacting with her fellow academics, she trained students to go out to the community to gather information about what children eat. “We give the families a logbook,” she says, “and match this information with what the healers tell us and what we know to be nutritious diets from our own research.”

*Researchers at ORI reach out not only to colleagues in other disciplines but also to local people.*



She notes that “most scientists don’t like to talk with people out in the field.” But she strongly believes that part of her job is to help her colleagues overcome this reluctance. “When I began working with Kgathi,” she observes, “I told him I could teach him to talk with people. He didn’t believe me. But after a number of discussions, we went out and conducted interviews with local people concerning the spread of HIV. He discovered he was indeed able to talk with people about their lives and the risks they faced. And he was excited that he could do that.”

Kgathi subsequently played a key role in organizing much of the institute’s research in social science, including studies of resource shortages, rural livelihoods, risk, HIV/AIDS and tourism.

*We have a great deal of experience working in villages. We know them very well.*

# Expanding the Educational Agenda

The arrival of 15 graduate students from a number of different countries in 2009 has changed the tone and, to some degree, the focus at ORI by bringing “young blood” both to the laboratories and to fieldwork. According to the graduate coordinator, the ORI charter called for the development of a graduate programme. But it took a great deal of work to convince the main UB campus to alter its ways and launch the initiative. Ngwenya noted that “it is always difficult to change institutional customs, even when change makes sense.”

Masamba, who worked hard to change the minds of UB administrators, contends that ORI needed the students to reach its potential. “Everywhere I’ve been,” he says, “graduate



students are the heart of the research effort. My professor at the University of Florida depended on them. I did as well before I came here. Without students I felt like a fish out of water. Graduate students were the missing ingredients at ORI.”

Five of the ORI students are supported by RISE, the Regional Initiative in Science and Education. RISE supports students enrolled in institutions that agree to form networks with other institutions, giving students more flexibility in finding an advisor, research partners and laboratory instruments that may not be available at home. ORI is a member of the RISE-supported Sub-Saharan Africa Water Resources Network (SSAWRN), along with Rhodes University in South Africa, Makerere University in Uganda, and Eduardo Mondlane University in Mozambique.



The beginnings of an undergraduate education at ORI can also be detected in a brief intensive course on research methods held during the three-month winter break. UB students stay in screened tents on campus and work closely with mentors to carry out small, basic research projects, such as species sampling and hydrology measures that conform to the priorities of ORI. Their work concludes with a presentation to the full staff. “Students often challenge us with difficult questions,” says Ngwenya. “That’s good. You have to get across your research – why you’re doing it and what you hope to learn.”

Students, in turn, learn about what scientists do. “They go with us into the community. They see that we have to deal with different kinds of people, which is what makes the work more exciting and challenging,” Ngwenya observes.



Another innovation is a six-week intensive masters' degree course in "development practice." This course is intended for students from around the world who plan a career in development. ORI takes students to the community, where they interact with people and seek ways to establish and implement strategies that will promote sustainable economic development. The course, which is partially supported by tuition payments, is itself meant to be self-sustaining.

ORI brings to the course its extensive experience with the local people and the trust it has earned through many partnerships. "We have a great deal of experience working in villages," notes Chimbari. "We know them very well. We will work with the chief and other tribal authorities, and with the *kgotlas*."

*Our best hope is that policy-makers continue to rely on the soundest science in making decisions about the Okavango.*



# Future Bright

ORI will continue to do – and indeed expand upon – what it does best. That is, it will seek to develop and enhance its research expertise while increasing its outreach to the community. While limited funding from the university will mean that ORI will have less logistical and bureaucratic support, and that it will still need to comply with the guidelines of its international funders, its higher status as a full-fledged university institute gives it more freedom in managing its agenda.

An exciting prospect is the Ecosystem Services for Poverty Alleviation project, announced recently by the UK government for four regions of the world, including sub-Saharan Africa. With characteristic thoroughness, Chimbari has meticulously planned not only an ORI proposal from the three Okavango Basin countries, but also nurtured personal contacts that he hopes will bring success.





Since funding must come through a British partner, the institute is sending Caspar Bonyongo, a senior faculty member, to the UK to strengthen ORI's relationship with potential partners. "We started approaching individuals early on," Chimbari explains. "Our staff will also go to Gaborone to recruit faculty from the main campus to support us."

The heads of district departments, the tourism industry, the land board and the village chiefs are all represented in ORI's stakeholder advisory board. "A project will not go anywhere without them," says Chimbari. "The most important thing is for our science advisory board to be satisfied that what we're doing has both scientific merit and societal impact."

A major challenge for ORI has been recruiting new faculty to fill the 10 staff vacancies. Several factors work against them, especially when seeking to attract senior faculty. The value of Botswana's currency, the *pula*, has fallen by nearly half in the past decade and salaries have not kept pace with other countries. Other issues include the lack of advanced local medical care, which forces faculty to fly to Gaborone for checkups and treatments. There is also a general lack of cultural opportunities in Maun.

"Despite these obstacles, we can offer an exciting work environment for young researchers," Ringrose maintains. "For them, the financial package may not be as important as the challenges posed by the research agenda and the issues they will be able to explore. They are, after all, trying to build a career. For senior faculty with family commitments and retirement on the horizon, the challenge is much greater."

A challenge of a different sort is preparing for the new UB campus, which is planned to grow around ORI on a tract that is projected to expand from 60 to more than 100 hectares. Within the UB organizational framework, ORI is currently part of the division of academic affairs. But it will soon join a new division of research innovation and graduate study. The Maun campus will consist of four schools at the outset: applied ecology, cultural and heritage studies, tourism and hospitality, and entrepreneurship. The campus will have an estimated student population of 5,000. This represents an enormous logistical challenge that could drain the energy and skew the focus of all its constituent parts, including ORI.

Finally, an ongoing challenge that continually hovers over the work and plans of ORI is the competition for the water supplied by the “disappearing” Okavango River. In a region where drought is predominant, many potential users covet this precious resource. The Okavango River Basin Commission (OKACOM) is structured to address this issue in a rational and collaborative way. But no one can foresee the possible political changes or economic stresses that might suddenly disrupt the current civil discourse.



*ORI will continue to develop  
and enhance its research expertise.*

“The main problem for wetlands everywhere is drainage – people taking the water out,” says Eben Chonguica, OKACOM’s executive director. “Wetlands account for just two or three percent of the Earth’s surface. Yet they are vital to life and one of the most efficient mechanisms for carbon sequestration. Our best hope is that policy-makers continue to rely on the soundest science in making decisions about the Okavango.”



When the new ORI strategy was first announced, recalls Masamba, the institute was ready for change. However, it could not foresee the magnitude of what was about to unfold, or all the educational and political forces swirling around this small outpost of research and education.

“Our challenge has been to re-define ourselves,” he recalls. “And we are still in the middle of doing that – even as we continue to press ahead with our current research and community interactions.”

Chimbari is equally convinced that ORI can make a difference. “Our banner is ‘engaged research,’” he says. “There has been a lot of debate about that. But it’s our aspiration. We have new positions for PhDs. We are not a small operation. We have an impact now. But we can have an even greater impact in the future.

In southern Africa, people have been afraid of scientists, would never go near them let alone listen to what they had to say. We plan to change that. I want to be able to go into any bar or sports club or school in Maun and ask someone: ‘What does ORI do?’ I want them to be able to tell me. I want them to understand the value of science in their lives. I have a four-year contract and, by the end, I expect to see a huge difference.”



# Acknowledgements

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## TWAS

- *ICTP Campus, Strada Costiera 11, 34014 Trieste, Italy*
- *Tel: +39 040 2240 327*
- *Fax: +39 040 224 559*
- *e-mail: [info@twas.org](mailto:info@twas.org)*
- *website: [www.twas.org](http://www.twas.org)*

## TWAS

TWAS, the academy of sciences for the developing world, is an autonomous international organization that promotes scientific capacity and excellence in the South. Founded in 1983 by a group of eminent scientists under the leadership of the late Nobel Laureate Abdus Salam, TWAS was officially launched in Trieste, Italy, in 1985, by the secretary-general of the United Nations.

TWAS has a thousand members from 90 countries, over 85 percent of whom live and work in developing countries. A Council of 13 members is responsible for supervising the Academy affairs. TWAS is assisted in the administration and coordination of programmes by a small secretariat, headed by the executive director. The secretariat is located on the premises of the Abdus Salam International Centre for Theoretical Physics (ICTP) in Trieste, Italy. UNESCO is responsible for the administration of TWAS funds and staff. The Italian Ministry of Foreign Affairs provides a major portion of TWAS funding.

The main objectives of TWAS are to:

- recognize, support and promote excellence in scientific research in the South;
- provide promising scientists in the South with research facilities necessary for the advancement of their work;
- facilitate contacts between individual scientists and institutions in the South;
- encourage South-North cooperation between individuals and centres of scholarship.

To achieve these objectives, TWAS is involved in various activities and collaborates with a number of organizations, especially UNESCO and ICTP.

For additional information, see [www.twas.org](http://www.twas.org).

## INNOVATIVE EXPERIENCES IN SCIENCE AND TECHNOLOGY SERIES

For the past decade, TWAS – in collaboration with several other organizations and funding agencies, including the UNDP's Special Unit for South-South Cooperation (UNDP-SSC), the Global Environmental Facility (GEF) and the Packard Foundation – has published a series of profiles of scientific institutions of excellence in the developing world. The case study on the Okavango Research Institute, which is summarized here, is the first with our new partners, the Science Initiative Group (SIG), which heads the Regional Initiative in Science and Education (RISE) with funding from the Carnegie Corporation of New York. Previous case studies can be browsed online at [www.twas.org](http://www.twas.org). For print copies of the profiles, contact [info@twas.org](mailto:info@twas.org). To learn more about SIG and RISE, see [www.ias.edu/sig](http://www.ias.edu/sig).

## SCIENCE INITIATIVE GROUP (SIG)

The Science Initiative Group (SIG) is an international team of scientific leaders and supporters dedicated to fostering science in developing countries.

Formed in 1999 to provide scientific and administrative oversight for the Millennium Science Initiative (MSI), SIG is currently governed by a six-member board consisting of three scientists from developing countries, two US scientists and an entrepreneur. SIG is administered by a small staff based at the Institute for Advanced Study in Princeton, New Jersey, USA. The group's informal structure allows it to take advantage of opportunities quickly and with minimal bureaucracy.

Thanks to strategic partnerships with other organizations and careful stewardship of grant monies, over the last 12 years SIG has parlayed some \$15 million in foundation grants into more than \$100 million in project support, consisting primarily of financing from the World Bank and governments.

Since 2008, SIG's main project has been the Regional Initiative in Science and Education (RISE), funded by Carnegie Corporation of New York. RISE prepares PhD and MSc-level scientists and engineers in sub-Saharan Africa through university-based research and training networks in selected disciplines. Its primary emphases are on training new faculty to teach in African universities and on upgrading the qualifications of current faculty.

For additional information, see [www.ias.edu/sig](http://www.ias.edu/sig).





## EXCELLENCE IN SCIENCE

This series of booklets – published by TWAS, the academy of sciences for the developing world – highlights successful scientific institutions in the South and explains how their research has both been sustained over a number of years and how it is helping their host nations achieve sustainable economic development.