ONGAVA
RESEARCH CENTRE

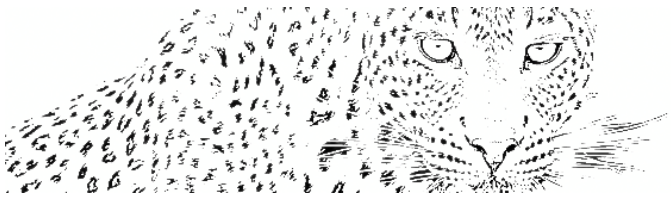
The challenge

The need to harmonise humanity with its environment has never been more urgent.

This alignment requires a reliable understanding of the natural environment and drivers of change.

An advantage

As an independent institution built by private investment, Ongava Research Centre (ORC) has the independence, goal and potential to answer major questions and understand processes fundamental to the functioning of the natural environment. ORC is therefore positioned to contribute information for humans to live in greater harmony with their natural environment, and vice versa.



Our purpose

Much of ORC's research will focus on organisms requiring conservation attention in and around Ongava and Etosha, for instance by investigating their population biology and genetics, as well as their ecological requirements. Research on broader processes that affect the biota in semi-arid and arid environments of southern Africa is a priority, for example by understanding movements, and the functioning of episodic events when most animals and plants reproduce. The results of this research will be of value to conservation and environmental management.

Studies will also focus on the great challenge that faces much of rural Africa: how can the prosperity of rural people and health of natural environments increase at the same time?

Much of this research will be done in collaboration with international and Namibian scientists and students who conduct studies of the highest standard. From these partnerships Namibian students will gain knowledge, inspiration, and experience. This will form an integral component of ORC's program dedicated to developing a new generation of committed scientists and conservationists.

These aims will be pursued in the long term since much of the best knowledge comes from investigations that incrementally build on understandings developed year upon year.

Our portfolio

Our project portfolio includes initiatives in several areas, as described in the pages that follow.

Contents

Our resources

From private initiative and small beginnings in 2005, ORC has developed into a well-regarded institution. A modern research centre built with private investment was opened in 2019. The centre comprises offices, laboratories, storage and accommodation for staff, visiting scientists and students.

ORC has already built an impressive collection of relevant data, which it continues to expand. For instance, over 7 million camera trap images of OGR wildlife have been tagged with keywords to facilitate analyses. Bio-indicator samples of natural materials and organisms are being collected and archived to help us understand processes and consequences of environmental change.

ORC is in Ongava Game Reserve, a few kilometres from Etosha National Park. As natural laboratories, both protected areas offer abundant opportunities for research. ORC has much to do in this ideal setting. Smaller projects will be funded by short term grants, but bigger questions require ORC to aim high and long in pursuit of their answers.

Therefore, two strategies will be used to fund research. The first will be grants awarded to ORC or its collaborators to support projects over relatively short periods.

The second will be to raise funding for longer term projects designed to answer major questions and support promising students. An endowment fund will support and secure the pursuit of a much-improved understanding of the natural environment together with its plants, animals, and people.

ORC's small staff will be energetic in pursuit of science, fellowship, and conservation.

1 Human wealth, environmental health, and climate change in rural Africa

The great challenge in rural Africa is to erase its double tragedy of tens of millions of poor people forced to degrade their natural environment to sustain themselves. Woodlands and forests are cleared on a large scale, and commodities with commercial value are often harvested beyond their capacity to recover. At the same time, the livelihoods of most rural residents remain impoverished and the drivers of climate change escalate when carbon emissions are increased by the fires used to clear the woodlands which then stop absorbing carbon dioxide.

But there are rural areas in which people are becoming wealthier while simultaneously reducing pressures on their natural resources. Such surprising and positive gains for people and the environment are being made without external drivers such as policy or development programmes.

Examples of improving livelihoods and reduced pressures on natural resources are to be found in South Africa, Namibia, Angola and the Democratic Republic of Congo, and other places in Africa. Experience in these countries suggests that livelihoods improve substantially when sizeable cash incomes become available. These provide families with the means to increase their food security (by purchasing food) and their income security. In turn, rural residents can reduce the need to clear land, and fewer natural resources must be harvested when energy and building materials are bought. The sources of these new incomes vary. Some are from local resources, such as new farm products, employment, or artisanal mining. Others are from remittances and social grants, which are then multiplied in value by local trade in goods and services.

If expanded, these changes may benefit rural families across the continent and its extensive natural habitats. Much is at stake, hence the urgent challenge to understand factors that propel these positive economic and environmental changes, and to encourage the spread of processes that promote their implementation. ORC intends to tackle this challenge by conducting studies in Namibia and elsewhere to answer questions central to understanding the changes. The answers will inform policy and practice on a range of topics, such as poverty alleviation, rural and urban development, environmental management and conservation, farming practices, domestic economic development, and stimulating the supply and multiplication of money in rural Africa.

Large parts of rural Africa are like this: woodlands and forests gone, and local residents in abject poverty.

2 The use of space

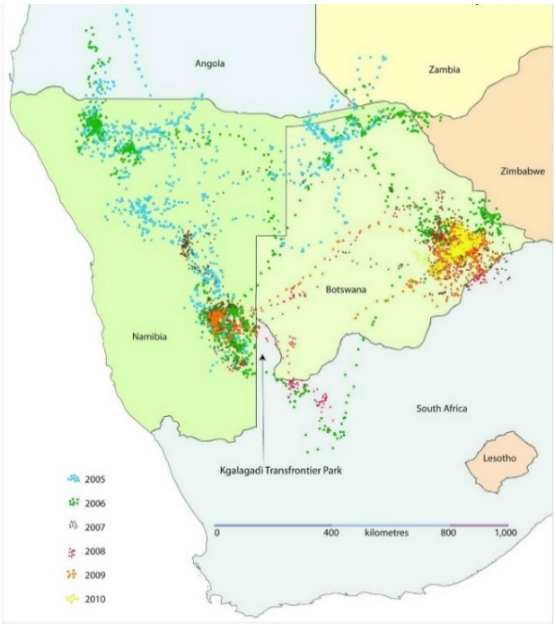
All organisms need space, but how much? What options do big mammals enjoy in large parks that those in small parks cannot? They should have access to more food, water and mates, and are perhaps less prone to disease and inbreeding. More space should be available for dispersal. But they may be more vulnerable to healthier competitors and poachers in large parks. What else? How have mammals, such as wildebeest and springbok that used to migrate across areas of southern Africa, adapted to being more confined by fences? **Why do animals turn back from certain roads, fences, rivers and even international or park boundaries that they can easily walk or fly across?** The map below shows how a young bird remained in Namibia and avoided the Kgalagadi Transfrontier Park.

Many animals must communicate over large distances, even for such obvious needs as finding mates. What communication media may be used: chemical pheromones, low frequency infrasound, or other types of messages? What chemicals can be detected miles away, or how can small animals generate infrasound? These are challenges for animals that occupy large spaces permanently.

Many places cannot supply all the resources that animals need throughout the year. Getting around is thus important, particularly in arid or semi-arid areas where rainfall and plant production varies greatly from time to time, and from place to place. This is why tens of millions of birds and other animals move widely to exploit patchy and unpredictable resources. What we do not know is how they assess where to move, when to move, and when to leave, for example. How they might assess other qualities, such as soil nutrients, soil moisture, habitat suitability, or the presence of wetlands that can hold water is another puzzle.

Most water birds in sub-Saharan Africa breed in temporary wetlands. For example, flamingos only breed in Etosha and Makgadikgadi when these pans flood. This is known. But the breeding grounds of most other wetland birds are not. It is also not known where many of these birds live when not breeding. Without answers to these basic questions, conservation measures cannot be identified, let alone implemented.

Understanding the uses of space, long distance communication and movements has obvious value if we are to maintain areas suited to the needs of wild animals.



The movements of a young, non-breeding female Cape Vulture between 2005 and 2010. How did she navigate, when did she decide to leave one area and go somewhere else, and how did she decide where that somewhere should be?[1]

The female spent long periods in south-east Botswana and south-east Namibia, hence the clusters of points in those areas.

3 Waterholes: sources of water and hubs for interaction

Supplying water to wildlife is vital in most protected areas in Africa. This where vast numbers of animals congregate. However, there may be other effects of providing water, some of them neither expected nor desirable. For example, waterholes may increase the transmission of parasites and pathogens, lead to higher rates of predation on herbivores, and to the loss of vegetation cover by trampling.

Given an abundance of places to drink, numbers of large herbivores may increase so much that grass and browse is exploited to an extent that it cannot recover during droughts. Herbivores then die off in large numbers, not from shortages of water but from scarcities of food. It may then be prudent to reduce the number of waterholes and/or increase their spacing.

The structure of waterholes and their surroundings can have unforeseen effects on the animals that use them. For example, dense cover around water may give predators an advantage in being able to hide and ambush their prey. Water contaminated with animal faeces may have high bacterial loads which cause animals to drink elsewhere. At Ongava, some animals drink from concrete ponds which hold fresher water while others seemingly prefer drinking from overflows in muddy pools. Why?

Clearly, there is much more to waterholes and water supplies than meets the eye. The occurrence and implications of possible effects must be documented, monitored, and understood to maximise the benefits of water supplies, especially in the semi-arid and arid conditions that prevail across much of southern Africa.

There are many artesian springs in and around Etosha, such as this famous waterhole at Okaukuejo.

Within a radius of about a kilometre much of the ground is bare from grazing, trampling and elephant damage over hundreds, if not thousands of years, and perhaps more.

4 Landscapes of fear

Animal numbers are limited mainly by predation, disease and the availability of resources, such as food and water. These are direct impacts. They are also curbed indirectly by fear, for instance by having to forsake food, water, and resting places in areas where predation or disturbance threatens. It is thus easy to see how the lives and breeding opportunities of animals can be curtailed where the risk of predation is high.

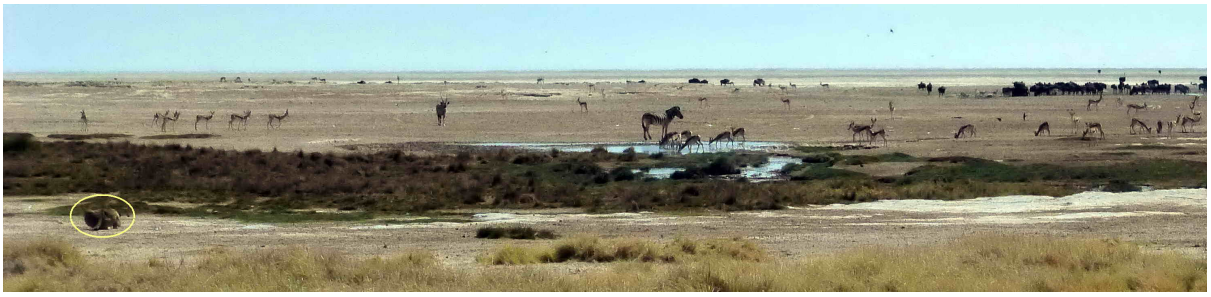
Perceptions of predation risk can be affected by multiple factors, including the physical landscape (e.g. vegetation cover) and the characteristics of both prey (e.g. body size) and predator (e.g. hunting tactics).

These circumstances are natural, or largely natural, and not affected by humans. But a great deal of other fear is of humans who so dominate the earth that there are very few areas where animals may relax. Many animals therefore spend much of their time and their energy avoiding people, secretively limiting their feeding, breeding, and resting to hidden places or to quiet times.

But we also know that animals can become accustomed to the presence of humans and live more happily alongside them. How does that habituation happen? How can it be facilitated? Under what circumstances is acclimatisation a priority? When should it be discouraged?

A similar challenge concerns measures to encourage animals to diversify their food and habitat choices, to being more generalist and less specialised in their needs. The greater the diversity of food they can eat or habitats they can occupy, the more options and possibilities they will have to breed and live. The Mauritius Kestrel conservation programme employed this approach. The total world population in 1974 was down to 3 males and 1 female kestrel, all living in one small remaining patch of primary forest. Dozens of kestrels were then bred in captivity, many of which were released and acclimatised to living in secondary forests and other degraded habitats where a much wider range of prey was available to them than before. Nowadays there are about 800 Mauritius Kestrels.

Research at Ongava can make similar contributions.



Drinking at Okondeka waterhole in Etosha is risky, requiring considerable patience and vigilance. Such prudence is a necessity in any landscape of fear, as emphasised by the stealthy lioness crouched in the left corner of the image.

5 Life in episodes

Life proceeds in predictable cycles in much of the world, from growth in spring, to breeding in summer and inactivity in winter. But in southwestern Africa and other semi-arid or arid areas of the world, life is partitioned between long periods of dormancy and short, unpredictable episodes of hurried reproduction and growth. Most plants and animals therefore spend years, even decades, waiting underground as seeds, eggs, spores, pupae, or inactive adults.

Think of all the grasses and herbs that appear after good rains; the frogs, catfish, and lizards; mushrooms and other reproductive organs of fungi; the spiders and scorpions; and insects: termites, moths, beetles, lacewings and many, many more. For every lone, long-standing tree, there are now ten thousand other growing plants; for every springbok there are now one hundred thousand invertebrates. The volume of life above grounds changes by orders of magnitude; the number of dormant organisms in the natural environment vastly outnumbers those that we see every day, and to which we pay all, or much of our attention.

As with nomadic movements, periods of episodic production are associated with rainfall. But the exact effects of rainfall and other factors of production are largely mysterious. Circumstantially, the volume of rain and its timing is relevant, but so is humidity, day length, evaporation and temperature. What else drives production, and how do these factors interact? And it is not only a matter of what starts the episodes and emergence of life, but also how long conditions suited to production persist, and what signals their end. How and when, for example, does a frog decide to bury itself?

These are among earth's major mysteries. And they concern the great majority of living organisms at Ongava and in other arid and semi-arid environments. As sporadic beneficiaries and spectators of all this life, humans wait expectantly in anticipation of the special conditions that reinvigorate the world.

Adaptations to episodic life and environments are responses to changing climates. What better way of understanding responses to climate change than to comprehend those solutions that have already been developed?

Following enough rain to fill temporary pools, adult African Bull Frogs (*Pyxicephalus adspersus*) emerge from the ground where they have been dormant for many months, even years. They mate soon, the fertilised eggs hatch rapidly, and the tadpoles grow quickly (the writhing mass seen here) under the watchful, protective eyes of their fathers before transforming into small frogs. With considerable speed, the young frogs feed voraciously and grow as large as possible before burrowing into the ground where all they can do is wait until the next good rains.

6 Southwestern Africa's enigmatic highland endemics

Between the Congo and Orange Rivers lie a range of plateaus, inselbergs, and escarpments. These southwestern African highlands are home to several hundred endemic plants and animals, species that occur nowhere else in the world. Some are even recognised as endemic genera. Many more endemics await discovery in this area, probably one of Earth's hotspots of endemism and biodiversity.

Many of the populations are known to be small, isolated from close relatives and restricted to refugia and habitats that are fast being encroached by human activities. Changes to the climate in these highlands may limit the viability of the populations. Very few highland areas are protected. Understanding the nature, origins and distributions of endemic populations is crucial to establishing their credentials as ecologically significant units, as well as identifying and motivating conservation priorities. Together with collaborators in Angola, Namibia, Portugal, South Africa and elsewhere, this project will:

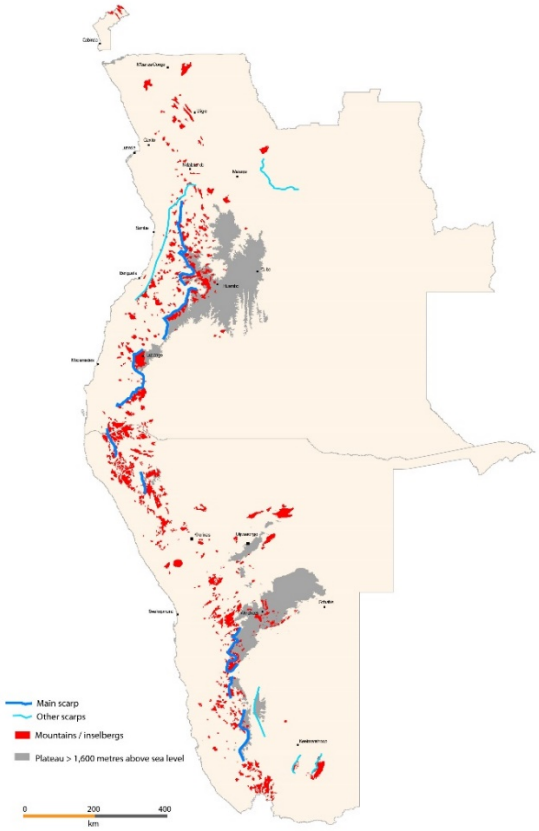
a) Establish the identities of populations on different highlands to refine taxonomic distinctions and measures of genetic difference *between* populations.

b) Assess possible connections and gene flow *between* different populations, as well as assess possible barriers to gene flow.

c) Establish likely mechanisms and circumstances that led to refugia and the isolation of populations,

d) Assess levels of genetic diversity *within* populations to provide measures of their likely health and resilience.

e) Deliver information about endemism and biodiversity in Africa's south-western highlands, with a view to identifying and informing priorities for conservation.



The highlands of south-western Africa in Angola and Namibia between the Congo river in the north and the Orange River in the south. Most are inselbergs which rise several hundred metres above their surrounds. Others are on the escarpments which rise steeply from lowlands to the west. Both countries have large plateaus in their central regions.

It is on these elevated lands that so many endemics live.

7 Greater Etosha's Carnivores

The Greater Etosha Landscape (GEL) in northern-central Namibia exemplifies global conservation challenges, especially those facing large conservation landscapes, such as South Africa's Greater Kruger NP, Tanzania's Serengeti NP, the Greater Yellowstone Ecosystem in the USA and Ranthambhore NP in India. **The GEL comprises one of the world's most renowned protected areas, the Etosha National Park, surrounded by a diverse matrix of land tenures and land uses, which translate into different management approaches and challenges faced by both carnivores and their human neighbours.**

While large carnivore research has a long history in the Etosha landscape, little is understood of the major drivers that support or constrain the carnivores that live here. Unsurprisingly, therefore, little or nothing is understood of how the population ecology of carnivores may respond to changing land uses and climate in and around the GEL.

The major goal of this project is to answer these questions:

1. How do pathogens, prey availability, interspecific interactions, water supplies, human effects, and genetic effects limit the number and distribution of carnivores in the GEL?
2. Based on an understanding of the effects of these drivers, how will carnivore populations and ranges be affected by climate and anthropogenic changes in the decades ahead?

To guide future research, ORC has compiled a bibliography of reports and publications produced over the past 110 years on carnivores in the Greater Etosha Landscape.

Five species of large carnivores (Cheetah, Lion, Brown and Spotted Hyaena, Leopard) and eight smaller species occur in the GEL (Cape Fox (above), Serval, Black-backed Jackal, Honey Badger, Caracal, African Wild Cat, Bat-eared Fox, and Aardwolf)

8 Future scientists and conservationists in Namibia

Science and conservation are not jobs. Instead, they are life-long pursuits driven by passion and creativity to know, understand and conserve the natural environment. Both vocations are built on the values of care, imagination, curiosity, investigation and understanding. These qualities are essential. Yet little is done to foster them among young Namibians. That is one challenge.

Another is Namibia's need for a new generation of scientists and conservationists to continue past and present work, but mainly to explore new ideas and horizons. Many of the most experienced professionals and technicians are aging, retired, or gone. Most of their potential successors, especially those that are ambitious and intelligent, are soon taken up by other more financially rewarding professions. And many young people are attracted to urban life, far from the natural environment that requires their services.

Where, then, is Namibia to find young, dedicated people eager to make science and conservation their careers? We commonly assume that schools, colleges and universities will produce graduates educated as scientists and conservationists. **Yet formal education is not enough,** and it is especially deficient in fostering inspiration and curiosity that leads to the enthusiasm and dedication needed for these careers.

ORC holds the view that it and similar organisations have a responsibility to help fill this gap, and to ensure that there are the right Namibians doing the right job. **Programmes are needed to expose young people to experiences, role models, mentors and information that fires-up curiosity and rational thinking.** These catalysts must be experienced in person, and with as much hands-on participation as possible to ignite zealous, quizzical minds.

Ongava Research Centre will thus provide programmes for young people to enjoy these opportunities, for example by interacting with inspiring scientists and leading conservationists, as well as having hands-on experiences with animals and plants and other components of the environment.

ORC will also generously support the post-graduate research of those with the greatest promise in becoming Namibia's new scientists and conservationists. **Here will be a meeting place for local and international scientists and students to exchange views, learn from each other and work to common advantage in the best interests of science and conservation.**

ORC's curriculum will concentrate on activities that inspire interest in biology, creativity in science, curiosity and exploration, and build alumnae committed to finding out what we need to understand for the natural world and the people it supports.

9 Ongava Game Reserve and Etosha's neighbours

Ongava Research Centre will support the development and management of Ongava Game Reserve (OGR) and the African Wildlife Conservation Trust (AWCT) in their conservation projects that support Etosha and its neighbours. The following are planned; of which some will be adjusted, and others added as demands and needs change:

Monitoring
On an annual basis, and more frequently when needed, ORC will provide information on rainfall and other climate parameters, vegetation production, land cover and use, the occurrence of bush fires, groundwater levels and qualities, fences and other barriers, the numbers and distribution of large mammals, and changes in land ownership and management.

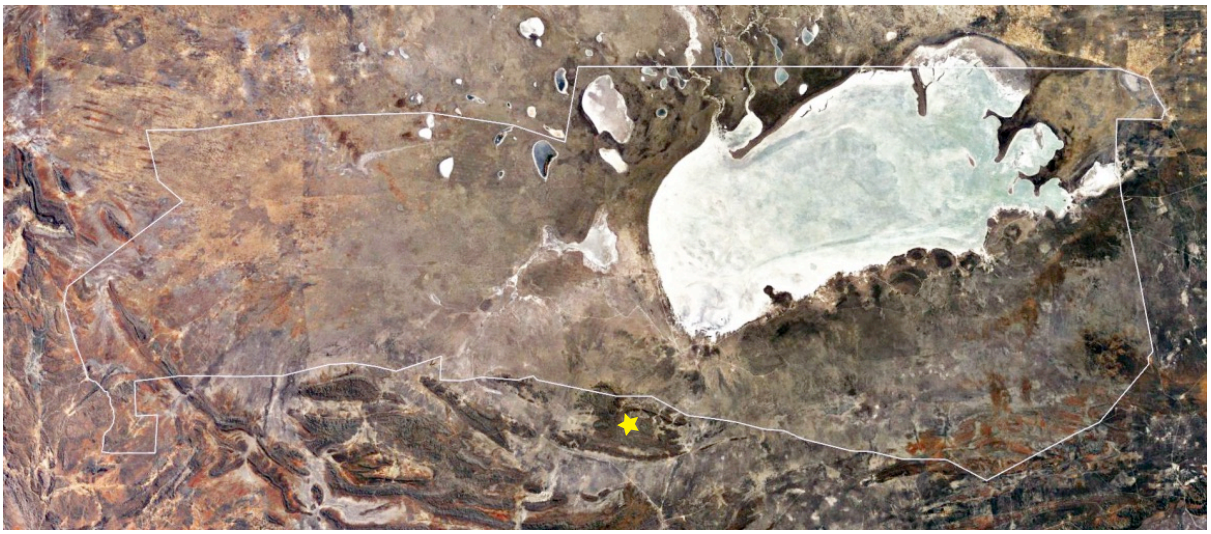
Development of previously disadvantaged residents
Monitoring will provide information on the progress of socio-economic development programmes, and on changing land uses and livelihoods. Research will investigate desired and viable development programmes, while accounting for historical, political and current circumstances, and development options and aspirations.

Social cohesion of members of landowners neighbouring Etosha.
Consultative studies will gather information on attitudes and aspirations of landowners and managers; and seek trajectories that optimise their interests and the goals of conservation programmes around Etosha.

Land use planning
ORC will provide information and advice on current, viable and desirable land uses.

Assessment and planning of developments for rhino populations
ORC will provide information, options and advice on the placement of custodian rhinos, and changes that might be needed in the distribution and demography of existing populations.

Mapping
Given ORC's data resources and experience, it will be well-placed to provide mapping services and spatial planning information.



Etosha pan and Etosha National Park's borders. Ongava is located at the star.

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