

THE BAVIAANSKLOOF

CONSERVATION AREA

André Boshoff

Richard Cowling

Graham Kerley

A CONSERVATION AND TOURISM DEVELOPMENT PRIORITY



The Kouga-Baviaanskloof area is a veritable treasure trove for San rock art (Photo: T.J. Coetzee).



Marked altitudinal and climatic gradients are a feature of the area. Here winter lays its icy hand on Cockscomb peak in the Groot Winterhoek mountains (Photo: G.I.H. Kerley).

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Front cover: The northern foothills of the Kouga Mountains – an African Land Surface with prominent bitter aloes (*Aloe ferox*) in a rooigras (*Themeda triandra*) grassland. The slopes below this plateau are covered in succulent thicket, whereas the Baviaanskloof Mountains in the background are clad in a variety of fynbos vegetation types. Such is the great ecosystem diversity of the Baviaanskloof Conservation Area (Photo: R.M. Cowling).



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The Baviaanskloof Conservation Area (BCA) is a 174 400 ha reserve 75 km northwest of Port Elizabeth in the Eastern Cape Province, South Africa. It lies in the Cape Floral Kingdom, a region internationally renowned for its spectacularly high endemic plant richness. Within the Cape Kingdom, it is one of only three areas identified for mega reserve status (> 500 000 ha). **Given its large size, varied terrain and wilderness context, the BCA has the potential to sustain and maintain biodiversity indefinitely.** The reserve has not received the recognition and support that it deserves.

The Baviaanskloof environs, in common with much of the Eastern Cape countryside, is facing growing socio-economic problems due mainly to the decline of the agriculture industry. There are no concrete development plans to remedy this. The future of the small and isolated human population living on private land in the western sector of the valley is particularly bleak. **The greatest potential for substantive socio-economic development in the area is conservation/tourism**, which is firmly in line with national, provincial and regional government policies and strategies.

The size and shape of the existing BCA is deficient in terms of effective biodiversity conservation. Consequently, **the reserve must be expanded in order to achieve biological viability.** This report highlights a motivation to consolidate (through the purchase of land) and expand (through the conservancy model) the BCA. This proposal will achieve goals for conservation, enable effective water catchment management and provide enhanced tourism opportunities.

The BCA and environs is extremely rich at all levels of biodiversity. The spectacular landscapes harbour a flora rich in species (1161), genera (556) and families (135), as well as a great diversity of vegetation types representative of six of South Africa's seven biomes. The fauna is also extremely rich, due to high habitat diversity and complexity, and to the region's position as a stable refuge for palaeoendemic (ancient) species. As many as 46 species of medium- to large-sized mammals can potentially be supported in the area, including Africa's Big Five (lion, leopard, African elephant, black rhinoceros, Cape buffalo).

As the meeting place for the diverse cultures of the San (hunter-gatherers), Khoekhoen (herders), Bantu-speaking groups (agro-pastoralists) (possibly) and settlers of European descent, **the Baviaanskloof area has an exceptionally rich cultural history and prehistory.**

The Baviaanskloof area plays a vital role as the sole water catchment for the thriving agro-economy in the Gamtoos Valley, and as a major source of water for the rapidly growing Port Elizabeth/Uitenhage metropole.

A number of factors pose real and potential threats to the BCA. Its natural environment and water services are impacted by overgrazing, invasive alien plants and harmful animal introductions. The institutional/policy framework suffers from ineffective management models, a lack of funds and personnel. Socio-economic interventions threaten in the form of ill-considered land settlement schemes and inappropriate peripheral developments. **This situation requires urgent attention**

from key stakeholders at national level: Departments of Agriculture, Environmental Affairs & Tourism, Land Affairs, and Water Affairs & Forestry (including the Working for Water Programme); at provincial level: Department of Economic Affairs, Environment & Tourism and Eastern Cape Tourism Board; and at local level: Western District Council.

This report makes the following recommendations:

- The BCA must be **managed by an authority that has sufficient financial and human capacity** to fulfil this function effectively. The management agency must operate according to a model that allows it to retain income, take out loans, appoint suitable staff, etc.
- Owing to the severe threats, and the high conservation value of its ecosystems, **the first priority for conservation action should be the expansion and consolidation of the western sector.** The next priority should be the expansion northwards into the Nama-karoo and southwards to the Kouga River.
- Every effort must be made to ensure that **expansion is done in a socially sustainable way** and the reserve must provide a series of immediate benefits. In this regard, explicit targets for job creation and other socio-economic opportunities must be set.
- As a matter of urgency, a **comprehensive and professional socio-economic study needs to be conducted on the various land-use options**, prior to any land settlement schemes being implemented on private land adjoining the BCA.
- The **BCA project requires an impartial "champion"** – to promote, facilitate and co-ordinate research, planning and development actions, and to develop a synergy within the entire spectrum of stakeholders.
- **Most of the reserve must be zoned and managed as a wilderness area.** Tourism activities and development nodes must be restricted so as not to compromise this status.
- The BCA, in its existing or expanded form, **must be awarded national protected area status** and conform to Category Ia, Ib, II and III IUCN Protected Area Categories. Its eligibility for World Heritage Site status must be assessed.
- **Research must be undertaken to fill gaps** in the biological, ecological and cultural history inventories. This information is important for regional, national and international conservation planning in the future.
- **International funding must be secured** to cover the incremental costs of implementing the expanded reserve.
- **The BCA must not be developed in isolation.** For example, the outcomes of the CAPE Project in relation to the reserve need to be developed further in the context of a bio-regional development plan.

INTRODUCTION

In the western region of Eastern Cape Province, South Africa, lies the Baviaanskloof or "Valley of Baboons". It is a valley between two parallel east-west running mountain ranges, the Baviaanskloof Mountain range across the north and the Kouga Mountain range across the south. Straddling these mountain ranges and part of this valley is the Baviaanskloof Conservation Area (BCA), a 174 400 ha protected reserve. Its southern boundary is some 35 km from the Indian Ocean and its eastern boundary is 75 km northwest of the city of Port Elizabeth (Map 1). To the south of the Baviaanskloof, and running east-west between the Kouga and Tsitsikamma mountain ranges, is the valley known as the Langkloof.

The BCA is the fifth largest of 422 protected areas in South Africa, and by far the largest in the Eastern Cape, the most bio-climatically diverse of the country's nine provinces. It is considered to be one of the most important protected areas in South Africa, mainly for the following reasons:

- Its large size makes it one of the few reserves in the country that has the potential to conserve not only biological patterns (species, habitats, etc.) but also the ecological processes that sustain these.
- It offers outstanding opportunities for cultural conservation.
- It offers excellent potential for responsible tourism development, leading to widespread socio-economic development opportunities locally, regionally and nationally.
- It fulfils a vital role in providing a sustained yield of high quality water for the Gamtoos River valley agro-economy, and the urban and industrial needs of the Port Elizabeth/Uitenhage area.

There are, however, a number of threats to the future status of the BCA:

- It has a relatively low profile in regional, national and international conservation circles and has not received the recognition that it deserves.
- There is uncertainty over the future status of private land on its borders and there is a danger that inappropriate land-use options could conflict with the conservation/tourism option and water services.
- The provincial conservation agency that manages the reserve is subject to major human, financial and institutional constraints.
- There is no bio-regional development plan to place the development of the BCA in a broader context.

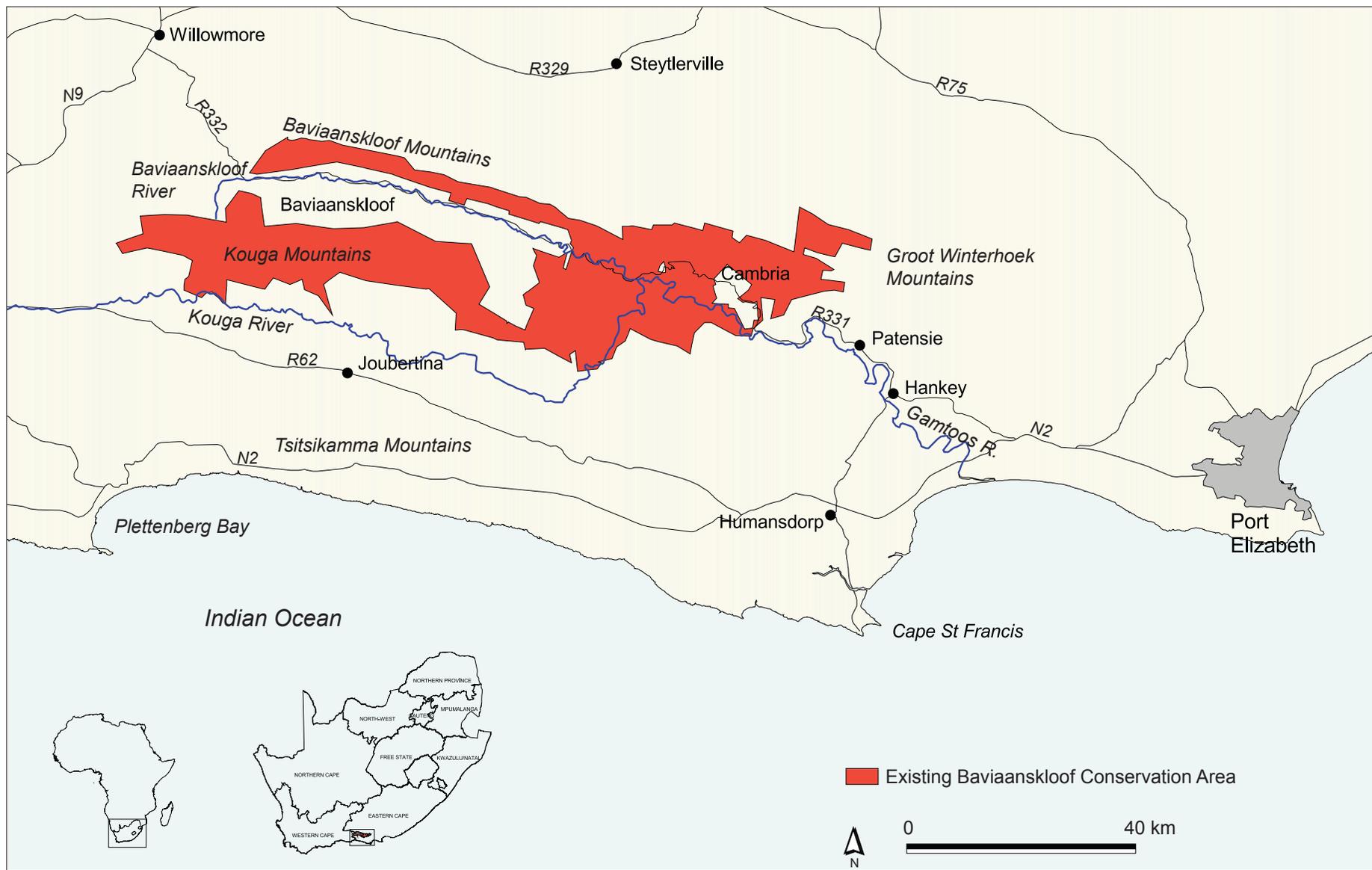
Given the above, there is an urgent need to promote the BCA, to assess its conservation and development value in a regional context, and to stimulate an initiative which would see it providing maximum conservation and socio-economic benefits

through sustainable development opportunities. The present document, compiled from the literature and local expertise, seeks to:

- highlight the significance of the area for biodiversity (species, ecosystems, landscapes) conservation, and assess it in a regional context;
- evaluate the conservation and socio-economic development potential of the area based on the tourism industry, and in terms of provincial, national and international policy;
- highlight the cultural significance of the area;
- emphasise the vital role of water provision;
- identify gaps in the knowledge base and identify some of the major threats facing the area;
- provide a framework for detailed planning by provincial and national conservation agencies;
- provide a motivation for attracting the interest of national and international governmental and non-governmental conservation funding agencies;
- make recommendations for a way forward.

This document does not aim at a comprehensive synthesis of all the information available for the reserve. Rather, it provides the framework for an action plan that will lead to the establishment of an expanded BCA, which will achieve a wide spectrum of conservation targets and, hence, will retain its biological integrity indefinitely. A strategically and efficiently expanded BCA will yield a wide range of goods and services, in particular water but also tourism opportunities. If current forms of land-use on the periphery of the existing BCA are allowed to persist, especially in areas critical for fulfilling key conservation targets, an opportunity for achieving both biologically and socially sustainable development in the area will be lost forever. This report seeks to stimulate actions that will realise the vision of a biologically, economically and socially viable reserve.

See page 50 for a list of acronyms used in the text.



Map 1: The location of the existing Baviaanskloof Conservation Area, indicating the position of some places and features mentioned in the text (Source: CAPE Project and Terrestrial Ecology Research Unit).

3.1 Biodiversity and conservation

The existing BCA lies at the eastern end of the Cape Floral Kingdom (Cape Kingdom) (Map 2) and, as such, it falls within the smallest and most distinctive of the world's six floral kingdoms. The Cape Kingdom includes 9 000 plant species (69% of which are endemic – i.e. grow nowhere else), 988 genera (16% endemic) and 173 families (seven of which are endemic or near-endemic).

The Cape Kingdom is also a centre of diversity and endemism for many animal groups, especially invertebrates, freshwater fish, amphibians, reptiles and smaller mammals. The region supports the oldest and least disturbed component of the ancient Gondwanan fauna, once shared among all parts of that long-fragmented palaeocontinent. Notable palaeoendemics are velvet worms (Onychophora), harvestmen (Opiliones) and stagbeetles (Lucanidae).

Owing to its unique biodiversity and the extensive and escalating threats to its plant and animal life, the Cape Kingdom has been identified as one of the world's 25 "biodiversity hotspots" for conservation priorities. Almost 25% of its natural habitat has been entirely destroyed, mostly by agriculture but also by dense infestation of alien trees, and urbanization. Much of the remaining habitat is under severe threat, principally from rapidly invading alien plants and, in certain areas (e.g. Cape Town and Port Elizabeth metropolises, Garden Route), from urbanization. It is not surprising then, that the Cape Kingdom harbours some 1 435 plant, and 112 animal species variously threatened with extinction (i.e. having Red Data Book status). The latter figure is almost certainly an underestimate since very few of its rare and endemic invertebrates are listed.

Further global recognition for the Cape Kingdom includes its identification by the International Union for the Conservation of Nature (IUCN) as a Centre of Plant Diversity, by Birdlife International as an Endemic Bird Area, and by the World Wide Fund for Nature (WWF) as a Global 200 Ecoregion. The growing concern for the future preservation of this important biodiversity asset has resulted in the initiation of the Cape Action Plan for the Environment Project. This CAPE project, funded by the Global Environment Facility, has as its major objective the identification of a system of conservation areas, and specific projects to implement this system, that will lead to the conservation of the region's biota (terrestrial and marine) in an ecologically, institutionally and economically sustainable way.

Conservation planning outcomes of the CAPE Project show that the existing reserve system for the Cape Kingdom is grossly inadequate for achieving realistic targets for the conservation of its biodiversity. While some 11% is covered by statutory reserves (national parks, provincial nature reserves and DWAF reserves) (Map 2), this system is strongly biased in favour of mountain habitats. Hence, 26% of the mountainous area is conserved in comparison to only 3% of the lowlands.



1



2

1. The Cape Floral Kingdom, which includes the Baviaanskloof Conservation Area (BCA), is renowned for species-rich plant genera. One such genus is *Erica* with a massive 720 species in the Cape. Shown here is *E. newdigateae* growing on steep, shaded slopes of the Baviaanskloof Mountains (Photo: R.M. Cowling).

2. Although the Cape Floristic Kingdom is recognised as a distinct region for birds, it does not support a high species diversity. This is most likely a consequence of the uniform structure of the vegetation and its overall low productivity. However, the region does have six bird endemics, including the orange-breasted sunbird (*Nectarinia violacea*) (Photo: T.H. Wooldridge).

Moreover, of the 88 Broad Habitat Units (or vegetation types), reservation targets (set as hectares of intact habitat) have been achieved for only 17. For 15 Units, habitat destruction has been so extensive that it is impossible ever to achieve reservation targets.

Conserving areas of habitat – or biodiversity patterns – is not sufficient to secure



effective conservation. It is also essential to conserve the processes, ecological and evolutionary, that sustain and generate species and communities. This can be done by identifying the spatial components of these processes (e.g. climatic gradients along which species migrate and diversify) and setting explicit targets (i.e. size, number and location of components) for reservation.

One of the recommendations arising from the CAPE Project is the identification and implementation of mega conservation areas. These are essentially wilderness areas, comprising at least 500 000 ha of intact habitat, and capable of sustaining all processes necessary for the long-term maintenance of biodiversity. We provide more details on mega conservation areas in Section 4.3. Suffice to say that owing to its unique biodiversity features, and numerous options for expansion, the BCA was identified as one of three mega conservation areas for the Cape Kingdom. The other two are the Little Karoo and Cederberg Conservation Areas.

3.2 Policy

National policy

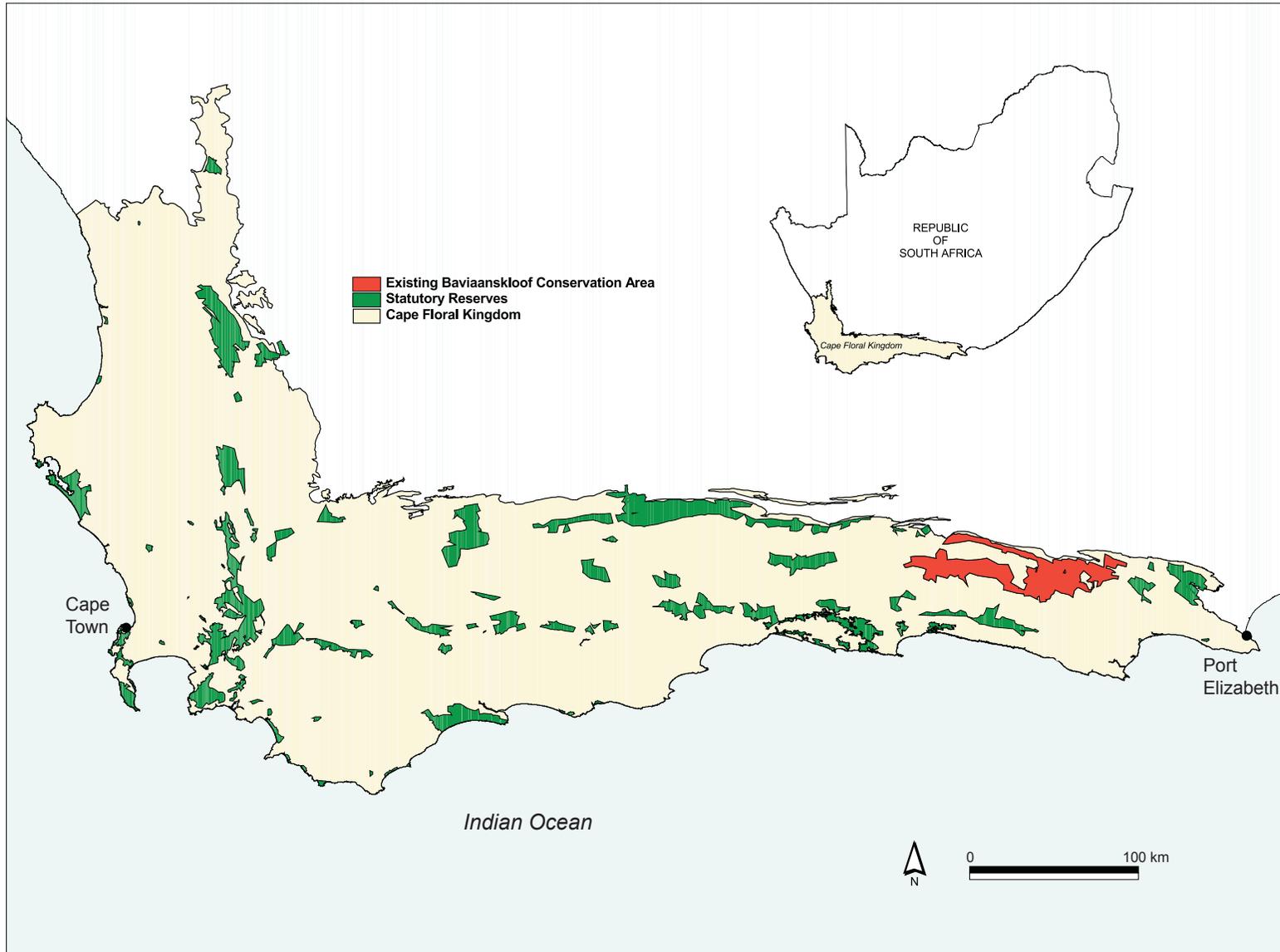
The South African Government has three overriding priorities: the eradication of poverty, the sustainable development of its economy, and the social development of its people. A Bill of Rights within South Africa's Constitution provides its citizens with "the right to an environment that is not harmful to their health or well-being, and to have the environment protected, for the benefit of present and future generations, through reasonable and other measures that prevent pollution and ecological degradation, promote conservation, and secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development".

The above priorities, together with national environmental management policy, provide the context for achieving the three objectives of the United Nations Convention on Biological Diversity, which South Africa signed and ratified in the mid-1990s, namely:

- the conservation of biological diversity,
- the sustainable use of biological resources, and
- the fair and equitable sharing of benefits arising from the use of genetic resources.

The Government has committed itself to fulfilling these objectives, and to a biodiversity policy and strategy (*cf* White Paper on the Conservation and Sustainable Use of South Africa's Biological Diversity 1997) that will promote reconstruction and development in South Africa through, *inter alia*,

3. The characteristic vegetation of the Cape Floral Kingdom, and the one that harbours most of its species, is fynbos. Typical components of fynbos include proteas, ericas and the reed-like restios. The brightly-coloured blooms of the narrow-leaf sugarbush (*Protea neriifolia*) are a characteristic feature of much of the fynbos of the Baviaanskloof Conservation Area (Photo: R.M. Cowling).



Map 2: The location of the existing Baviaanskloof Conservation Area and other statutory reserves (national parks, provincial nature reserves, Department of Water Affairs & Forestry (DWAF) reserves) in the Cape Floral Kingdom (Source: CAPE Project).

- ◆ ensuring that essential ecosystem services and biological resources required to meet basic human needs are protected and maintained, and
- ◆ enhancing the provision of jobs related to the conservation of biodiversity and the sustainable use of biological resources.

The biodiversity policy and strategy is set out in the White Paper in the form of six main goals, each with a set of policy objectives. The goals most pertinent to this document are: (1) to conserve the diversity of landscapes, ecosystems, habitats, communities, populations, species and genes in South Africa, (2) to create conditions and incentives that support the conservation and sustainable use of biodiversity, (3) to promote the conservation and sustainable use of biodiversity at the international level.

Provincial policy

According to a Draft Provincial Environment Green Paper, compiled by the Department of Economic Affairs, Environment & Tourism (DEAET) in 1997, the Eastern Cape provincial government commits itself to a biodiversity policy which adheres to the constitutional requirements of environmental protection, for the benefit of present and future generations. It further states that the principal issues of concern to the people of the Eastern Cape are the improvement of the quality of life of the population, with particular reference to the rural inhabitants, the creation of job opportunities, and the sustainable use of natural resources which will contribute to the eradication of poverty.

Regional policy

The Regional Planning Committee of the Western District Council (WDC), which is the regional service agency, has identified environment as one of the top planning priorities in its area of jurisdiction. A needs analysis, conducted for the WDC in 1999, explicitly states that the region's natural assets and environmentally sensitive areas require protection. This analysis was carried out as part of a strategic planning exercise to identify and prioritise social development actions in the region under WDC jurisdiction.

In summary, the promotion of the BCA as a biodiversity conservation and tourism development priority is firmly in line with national, provincial and regional government policies, strategies and priorities. Furthermore, it is entirely consistent with South Africa's formal commitment to protect its globally significant biodiversity.

3.3 Socio-economic

National status

The Eastern Cape Province has the second lowest Human Development Index (HDI) of South Africa's nine provinces, and one which is well below the national mean. The HDI, which was developed by the United Nations Development Programme, uses life expectancy and adult literacy to derive an index of human capacity. This province also has the second lowest personal income per capita, and the second highest unemployment rate.

Baviaanskloof Conservation Area environs

The general area surrounding the BCA is facing growing socio-economic problems. The economies of the small towns in its vicinity, namely Hankey, Patensie, Steytlerville, Willowmore, Joubertina and Kareedouw, are based almost entirely on the commercial agricultural sector, involving a mixture of pastoralism and irrigated crops (mainly citrus and deciduous fruit but also some cash and seed production crops). The economies of these towns, and the districts which they serve, have all undergone changes of fortune in the past decade, many of which are related to the major political, social and perhaps environmental changes that have impacted the South African landscape during this period.

In the Willowmore magisterial district, agriculture makes by far (>30%, versus <20% for all other activities) the highest contribution to Gross Geographic Product (GGP), but in economic terms the agricultural sector is operating at capacity and there is limited scope for growth. Many farmers are cutting costs and catering for new legislation by reducing the size of their permanent and seasonal labour forces. The steady decline in employment in the agricultural sector in the Willowmore area is illustrated by a 10% drop in the number of employees per ha from 1981 to 1988, and a further 10% decrease from 1989 to 1993. Gross income from agriculture changed little from 1988 to 1993 and therefore, taking inflation into account, real income has decreased by about 50%.

These changes are reflected by an overall decline in the economies of the districts and towns, accompanied by a general depopulation of the rural areas. The latter is taking place through the movement of unemployed farm workers and pensioners to the towns, with pensioners taking advantage of the government's housing subsidy scheme. There is a dearth of permanent and casual job opportunities in the towns and official unemployment levels are high (urban - 50-60%; rural - 25-35%). These values exclude the Langkloof, where both the urban (25%) and rural (14%) levels are somewhat lower. Unofficial figures place unemployment in Willowmore as high as 90%.

There is extreme poverty in the region, especially amongst rural women. In urban Willowmore, 59% of people with an income (employed or pensioners) earn less than R500 per month. The corresponding index for non-urban Willowmore is 75%. The Western District Council (WDC), which is the regional service agency, recognises the high tourism potential of the area and predicts that tourism has the greatest potential for economic development. However, it laments the lack of progress in this regard.

The Baviaanskloof

The socio-economic status of the small community which lives on the 56 000 ha of private land in the Baviaanskloof is of particular concern. About 800 ha of this area is under cultivation, of which about 100-200 ha can be used in good rainfall years. Virtually all the land is owned by 21 commercial farmers. The Congregational Church owns about 100 ha at Zaaimanshoek, where a number of pensioners and their extended families live in poor conditions, their income based solely on pensions and government grants. Pensioners, farm workers and their extended families make up approximately 72% of the valley community. There has been a steady emigration from the valley, owing to the paucity of employment opportunities, the lack of a secondary school, the poor and expensive services and people moving to Willowmore.



4

4. The economies of small towns in the area are progressively declining, largely because incomes are becoming increasingly based on pensions and welfare, rather than on a young and economically active sector. The future of government subsidies to these towns is uncertain, and income generated by municipal authorities in towns such as Willowmore cannot keep pace with the demand for additional services resulting from people moving from farms into town (Photo: D.J. Boshoff).

to take advantage of the housing subsidy. The population decreased by about 50% between 1994 and 1999 and currently stands at about 1000 people. For those that have remained in the valley, the future appears to hold little promise.

Much of the already limited arable land in the valley has been lost as a result of flood action and manipulation of the river channel, thereby reducing the expansion potential for irrigated crops, and overgrazing has reduced the sustainability and profitability of commercial pastoralism. Consequently, permanent and casual job opportunities in the valley have decreased significantly since 1994. Of those with permanent employment in the valley, 45% are employed as agricultural workers and are thus particularly affected by the waning fortunes of agriculture.

The population is sparsely dispersed within the valley, making it difficult to provide cost-effective services. Consequently, residents are increasingly being forced to travel to the nearest town (Willowmore) to purchase the required services. Depending on a person's exact location in the valley, a return journey to Willowmore is between 90 and 220 km but there is no public transport and the hiring of pri-

vate transport is very expensive. There are farm stores in the valley but the cost of goods is 20-100% higher than in town.

The future

In socio-economic terms, the future of the BCA environs is indeed bleak. Many of the negative socio-economic factors that apply to the valley are valid for bordering areas, especially in the low rainfall area to the north where commercial pastoralism is becoming increasingly marginal. Given the nature of the area, and some of the factors discussed above, the agriculture-based industry, as the primary form of land-use, is unlikely to provide the significant economic boost required to address the unemployment problem. There are no economic development plans on the horizon and it can be expected that the social decline will continue, with accelerated depopulation of the districts and increasing poverty and hardship in the under-served towns, where job opportunities are becoming increasingly scarce. It is clear that new initiatives are urgently needed. Conservation/tourism is an alternative and sustainable form of land-use which has the potential to contribute to the economy of the area, and the region as a whole, with accompanying social upliftment (see Section 8.3).



5

5. Current agricultural practice in the Baviaanskloof is possible because of access to free, unrestricted water, low wages, and non-compliance with agricultural, labour and water legislation. The nature of the habitats in this area makes it largely unsuitable for sustainable, commercial pastoralism. The stocking rate is low and the stock production potential has been significantly reduced in many parts by overgrazing (Photo: J.D. Buckle).



6

6. The long distances over poor roads to the markets, together with escalating production costs and the high cost of fuel and vehicle maintenance, place commercial farmers in the Baviaanskloof at a competitive disadvantage relative to farmers elsewhere (Photo: D.J. Boshoff).



7. As the population of the Baviaanskloof declines, so does the provision of services by local and regional authorities. This is largely owing to a shortage of resources available to these authorities and an increasing difficulty in justifying the costs of providing a full range of services (e.g. policing, health, welfare and education) to a small and isolated community (Photo: D.J. Boshoff).



8. Poverty is rife in the Baviaanskloof: 19% of households have a monthly income of less than R500 and 75% of the household income of disadvantaged people is from welfare schemes (Photo: D.J. Boshoff).

4 CONSERVATION INITIATIVES

4.1 Conservation history

The early years: 1900-1970

The bulk of the present BCA (174 400 ha) has never been privately owned and has always been under some form of protection. Previously classified as "Crown Land", it came under the formal management of the Department of Forestry in 1923, as the Baviaanskloof Forest Reserve (BFR). The Department's policy was one of "mountain protection" and this was the primary function of the forester in charge, who was



9. The European settlers in the Baviaanskloof removed considerable amounts of timber of the Willowmore cedar (*Widdringtonia schwarzii*) for fencing and building material. This contributed significantly to the present threatened status of this tree, which grows only in this part of the Cape Floral Kingdom. However, owing to inaccessibility, magnificent stands of Willowmore cedar can still be found in the Baviaanskloof Conservation Area (Photo: R.M. Cowling).

then stationed in Prince Albert. The first resident forester in the Forest Reserve was appointed in 1930. As there was no accommodation in the Reserve at the time, he obtained board and lodging at the police station on the farm Klipfontein. He was later joined by another forester and their duties focused on reconnaissance, impounding livestock which strayed onto the reserve and "controlling" fires. In 1940 further steps were initiated to establish proper control over the area and cut boundaries were introduced and fences erected to separate state and private land.

Until the 1960s, the 66 000 ha Baviaanskloof Forest Reserve consisted of two separate sections, *viz.* the core catchments of a northern section formed by the Baviaanskloof Mountains, and a southern section formed by the Kouga Mountains. In the 1950s and 1960s forestry policy for the mountain catchments (including the BFR) was still largely focused on preventing and controlling wild fires, mainly through the implementation of a system of firebreaks and controlled burns. The overall aims of the mountain catchment management policy were to maintain vegetal cover, minimise soil erosion and promote a sustained yield of high quality water. During this period forestry scientists and managers came to accept fire as an essential management tool in fynbos mountain catchments.

Transition: 1970-1989

In 1970 the Mountain Catchment Areas Act was promulgated, which meant that the overall aims of mountain catchment policy described above were expanded to include "nature conservation" and "public recreation". The Act also provided the basis for the implementation of a programme of prescribed burning in catchments. From 1970 the Baviaanskloof Forest Reserve was managed in terms of the new Act.

As a result of the construction of the Kouga Dam (formerly known as the Paul Sauer Dam) in the mid 1960s, large areas of land on either side of the Kouga River were purchased; these were transferred to the Department of Forestry in 1977, to be managed as catchment. As additional funds became available and more staff were appointed in the mid-1980s, more intensive catchment management was practised by the Department of Forestry. A number of roads were constructed during the 1970s to improve access to the area by management staff; these are now a source of erosion.

On 1 April 1987 the responsibility for the management of the BCA was transferred from the Department of Environment Affairs (including the Department of Forestry) to the Provincial Administration of the Cape of Good Hope. Since that date, the BCA has been managed as a provincial nature reserve, by Cape Nature Conservation (Cape Provincial Administration) from 1987 to 1993, and by the Directorate of Nature Conservation (DNC), Eastern Cape Department of Economic Affairs, Environment & Tourism (DEAET) from 1994 to the present. The DNC is now the Chief Directorate: Environmental Affairs (CDEA).

Since 1987 a total of 15 332 ha of land has been purchased (with the aid of private



10



11



12

10. A programme to eradicate invasive alien vegetation (mainly black wattle *Acacia mearnsii*, Port Jackson *A. saligna*, rooikrans *A. cyclops* and hakeas *Hakea* spp.) was initiated in the mid-1980s. It is well-known that these invasive species are a serious threat to biodiversity and reduce water production in fynbos-clad mountain catchments. In the 242 549 ha Kouga River catchment, some 81 422 ha (34%) has been invaded to varying extents by alien plants. The programme was recently greatly strengthened by additional funds from the highly successful Working for Water Programme of the Department of Water Affairs and Forestry (Photo: J.D. Buckle).

11. Populations of the previously extirpated Cape mountain zebra (*Equus zebra zebra*) (a Red Data Book species), red hartebeest (*Alcelaphus buselaphus*), Cape buffalo (*Syncerus caffer*) and eland (*Taurotragus oryx*) have been re-introduced to the Baviaanskloof Conservation Area (Photo: C. Urquhart).

12. A tourist office and camping facilities are offered at Komdomo at the eastern gateway to the Baviaanskloof Conservation Area (Photo: D.J. Boshoff).

funds from WWF-SA, SAA African Wildlife Heritage Trust, Willow Trust, Wilderness Leadership School and the Brodie Family (U.K.) and added to the BCA. This, together with some 4338 ha of land purchased by the State during this period, and the land purchased by the State for the Kouga Dam, enabled the consolidation of the eastern sector of the BCA.

Progress and problems: 1990-1999

Although the BCA has never been formally declared a wilderness area, it has been managed according to wilderness principles since the early 1980s. Since 1986 the fire management policy has been to phase out prescribed burning and adopt a "hands-off" approach to natural fires, except where neighbouring properties are threatened. By 1990, livestock transgressions had largely been curbed.

A Draft Management Plan for the entire reserve, completed in 1995, addresses, *inter alia*, management goals, zonation, land affairs, management priorities, management programmes and tourism operations. Since 1995 the provincial government's budget for nature conservation has decreased progressively and the human and financial constraints currently experienced by the CDEA mean that the Management Plan cannot be fully implemented. At the same time, many experienced conservation scientists and managers have left the provincial conservation department and have not been replaced. Consequently, only the very basic management activities are being maintained in the BCA at present (see Box 1). Notwithstanding these problems, some notable successes have been achieved during the 1990s (see Box 2).

Box 1: Basic management activities being maintained in the existing Baviaanskloof Conservation Area.

- Some alien vegetation control, largely with the aid of funds from the Working for Water Programme of the national Department of Water Affairs & Forestry (DWAF).
- Some wildfire control, mainly on boundaries to protect BCA neighbours and to prevent unnatural fires from entering the BCA.
- Essential maintenance of some roads and service tracks. Since the Western District Council (WDC) no longer makes resources available to maintain the public road through the Baviaanskloof, scarce Chief Directorate: Environmental Affairs (CDEA) funds are being used to keep the road passable.
- Some field patrols, for general observations, anti-poaching and tourist management.
- Maintenance and operation of six tourist accommodation sites (three campsites, three hutted camps) and one 4x4 route.
- Emergency repairs of boundary fences.
- Maintenance of two staff housing complexes (Studtis, Cambria).

Box 2: Notable conservation and tourism developments in the Baviaanskloof Conservation Area in the 1990s:

- Consolidation of the eastern sector, through the purchase of 15 332 ha of private land with funds from the private sector (see text).
- Compilation of a Draft Management Plan (in 1995) and concept development plans for tourist nodes.
- Founder or additional populations of certain large mammalian herbivores (Cape mountain zebra, eland, red hartebeest, Cape buffalo) were introduced.
- Removal of hundreds of km of internal fencing and of 400 feral cattle and over 500 feral donkeys.
- Building and operation of the Komdomo tourist campsite and renovation and operation of five other tourist accommodation sites.
- Operation of one 4x4 tourist trail and tourist horse trails.
- Publication of a detailed tourist hiking map, sponsored by the Savage Trust (Port Elizabeth).
- The Department of Water Affairs and Forestry (DWAFF) Working for Water Programme (1995 to 1999), involving the eradication of invasive alien plants.
- Erection of a seven km game-proof fence on the eastern boundary and permanent closure of, and initiation of rehabilitation measures on, redundant roads and tracks.

4.2 Current effectiveness

Most of the existing BCA was originally reserved and managed for catchment purposes (see Section 4.1). Hence, the boundaries were delineated accordingly, and not with conservation in mind. A consequence of this is that the reserve is not effective in conserving the full range of biodiversity patterns and processes in the region. Thus, for example, the northern boundary is located largely along the crestline of the Baviaanskloof Mountains, since only the wetter, southern slopes comprise a significant catchment area. This means that the ecosystems associated with the drier, northern slopes, as well as the transition between fynbos and the karroid ecosystems of the interior basin, fall outside the reserve. Similarly, the boundary precludes the lower, northern slopes of the Kouga Mountains. Unfortunately, the critical upper part of the Baviaanskloof River catchment is not in the reserve.

Not only does this configuration exclude entire ecosystems, but also makes it impossible to sustain key ecological and evolutionary processes within the reserve

(see Section 4.3). For example, it would never be possible to maintain viable populations of large herbivores such as the Cape mountain zebra without the inclusion of lowland habitat that enables the seasonal altitudinal migration of this species. Other large herbivores (e.g. eland, red hartebeest) which also undertake seasonal altitudinal migrations are denied this activity because of the configuration of the existing BCA. In addition, the present size and shape of the BCA is problematic for the conservation of its larger carnivores (e.g. leopard *Panthera pardus*, caracal *Felis caracal*, jackal *Canis mesomelas*). With their extensive hunting ranges, they are more likely to cover private land, thereby increasing their chances of being persecuted by stock farmers.

4.3 Current initiatives

The first initiatives to expand the BCA were undertaken in an *ad hoc* manner – there were no explicit targets to improve conservation effectiveness in terms of pattern and process representation. The implicit strategy appeared to be driven largely by management criteria (consolidation of isolated blocks). However, an incidental consequence of these initiatives was the inclusion of a large area of succulent thicket and savanna-bottomland ecosystems that were under-represented in the original area.

The mid-1990s, however, saw the development of conservation strategies for the BCA that incorporated targets for the representation of both biodiversity pattern and process, as well as considering management benefits. A key initiative in this respect is a proposal, compiled by CDEA in 1997, to consolidate and expand the western sector of the BCA. This concept involves the outright purchase of the 56 000 ha of private land flanking the Baviaanskloof River (Map 3). This area, which includes large tracts of land suitable for large indigenous mammals, would be zoned for nature-based tourism. A second component of the CDEA proposal is the creation of a sustainable, hunting and nature tourism-based economy on about 20 000 ha to the north of the existing BCA. Here private tenure would continue and landowners would be encouraged to pool resources for management and tourism benefits using the "conservancy" model.

The major benefits of this plan are as follows:

- Inclusion of areas of presently under-represented habitats (bottomland savanna) and unconserved habitats (e.g. karroid flats), as well as opportunities to conserve viable populations of many game species (e.g. Cape mountain zebra, black rhinoceros, Cape buffalo).
- Protection and appropriate management of the entire Baviaanskloof River catchment and associated ecological processes and services (water production in particular).
- Practical management benefits such as a reduction in the boundary perimeter, enhanced fire management, and more effective control of alien plant infestations.
- A substantial increase in tourism opportunities (e.g. nature-based, adventure, sports, hunting) with a concomitant capacity to create sustainable employment (see also Section 8.3).

The 1997 CDEA proposal implicitly considers the conservation of processes, including ecosystem services (see Box 3). The CAPE Project identified the BCA and surrounding areas as an opportunity to achieve a set of spatially defined targets for the conservation of biodiversity patterns and processes. Indeed, as mentioned in Section 3.1, the reserve and surrounding areas was identified as one of three options for the establishment of mega conservation areas in the Cape Kingdom.

Box 3: Ecosystem services provided by the Baviaanskloof Conservation Area

- ◆ A sustained yield of good quality water
- ◆ Clean air
- ◆ Carbon sequestration (extraction of carbon by plants from the atmosphere and storage, thereby reducing the greenhouse effect)
- ◆ Conservation of biological diversity
- ◆ Soil retention

Mega conservation areas comprise areas of intact habitat that are sufficiently large (250 000–1 000 000 ha) to support all of the processes necessary to maintain the persistence of biodiversity in the long term. Specifically, they should:

- include a diverse array of ecological gradients, in particular upland-lowland gradients, and associated habitats;
- encompass biome-scale transitions;
- include major migratory corridors;
- enable ongoing diversification of plant and animal lineages;
- support natural fire regimes;
- facilitate seasonal migration of fauna;
- and maintain plant-herbivore relationships and predator-prey relationships of all components of the extant and historical fauna.

Ideally, these conservation areas should also be linked to other conservation areas (see Section 8.4) in alignment with major climatic gradients in order to create mega corridor reserves. Such a configuration should:

- maintain migratory routes and evolutionary fronts between major climatic zones
- and facilitate shifts in species' distributions along macro-scale gradients in response to climate change.



13. The existing Baviaanskloof Conservation Area does not conserve the region's biodiversity patterns and processes effectively. Almost the entire valley of the Baviaanskloof River, with its productive savanna habitat and key role in water resources, is excluded from the existing reserve. As a result much of the alluvial valley floor has been cultivated and the succulent thicket of the valley walls has been severely degraded by overgrazing (Photo: R.M. Cowling).

The BCA provides an opportunity to create such a mega conservation area, together with linkages to other conservation areas, both extant and proposed. The conservation system identified in the CAPE Project is shown in Map 4. As a start, we propose that an expanded BCA should comprise the entire catchment of the Baviaanskloof River, a section of the karroid flats to the north of the Baviaanskloof Mountains and the area south to the Kouga River. A planning domain for a first phase expansion of the BCA is shown in Map 5. The expanded reserve will include all of the spatial components of the processes listed above (see also Section 8.1). In particular, it will:

- span the gradient from the arid Nama-karoo to mesic fynbos and forest,
- include much of the Groot-Baviaanskloof-Kouga riverine (migratory) corridor and
- encompass habitats such as grassland and mesic subtropical thicket that are restricted to the eastern sector of the Cape Kingdom.

The outcomes of the CAPE Project provide a solid basis for establishing an expanded BCA. From this point on in this document, our focus in terms of biodiversity, cultural environment, threats, opportunities and recommendations, is centred on this notional conservation area. We stress, however, that the boundaries of the planning domain in Map 5 are by no means to be considered as final.

The development of a conservation system in the BCA reflects a slow but steady progress from the proclamation as a water catchment area, to the consolidation of the reserve through the acquisition of key properties, and now to the identification of an expanded system that can achieve reservation targets for biodiversity patterns and processes, as well as provide essential ecosystem services and opportunities for sustainable economic development. Before addressing the threats and opportunities associated with an expanded BCA, we discuss in the next two sections of this document the biodiversity and cultural features of the area.



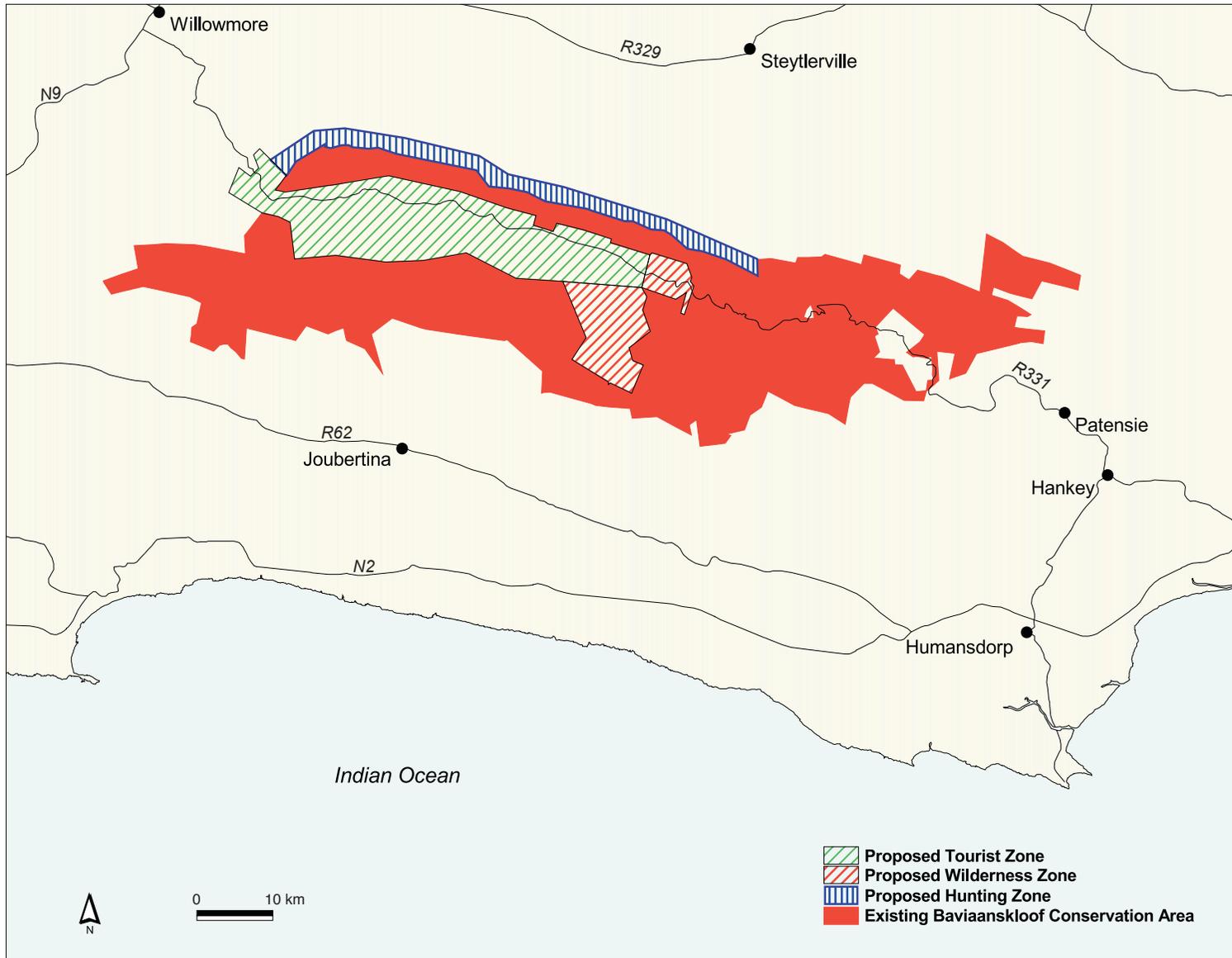
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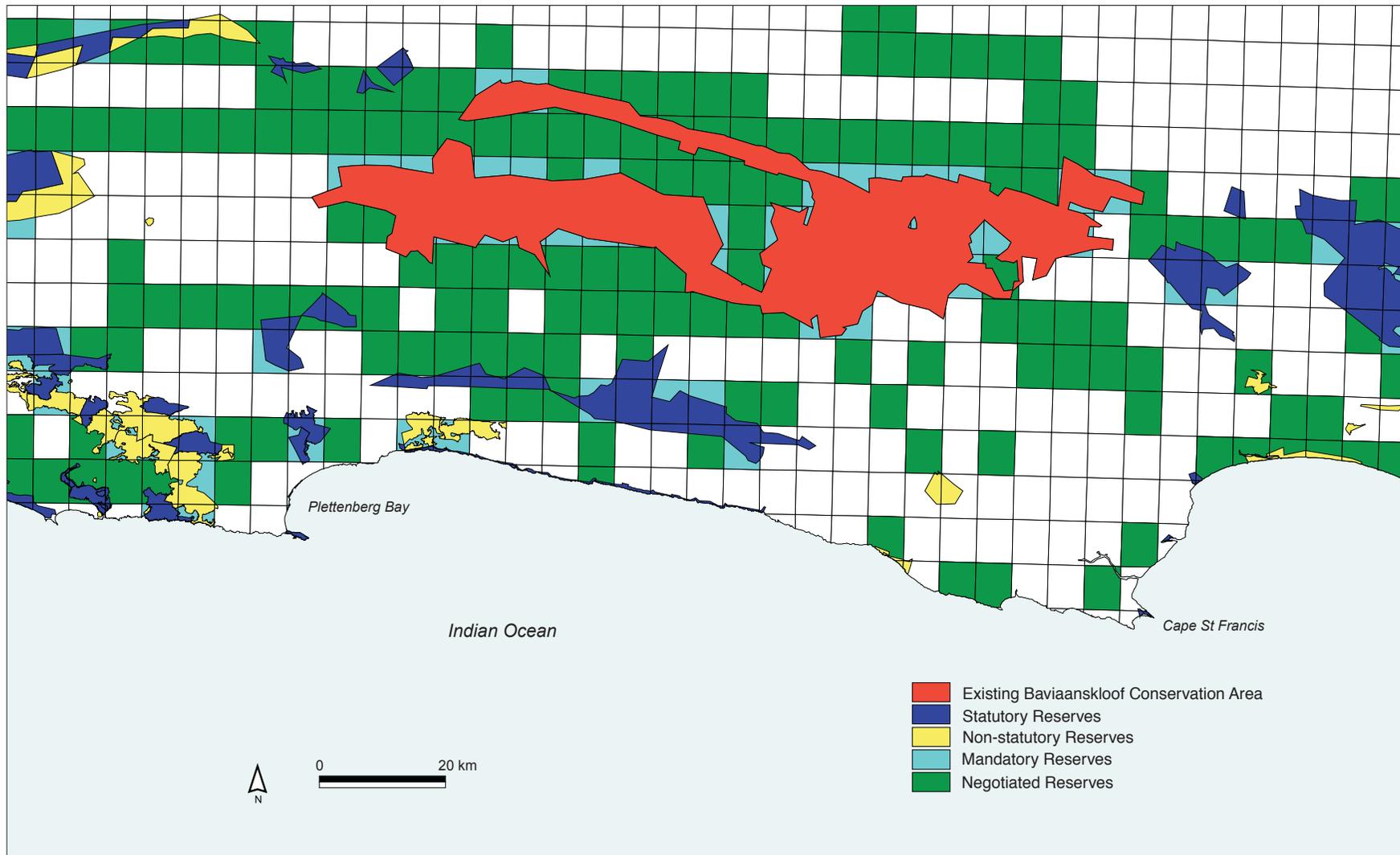
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14. An expanded Baviaanskloof Conservation Area will include the eastern margin of the Succulent Karoo, a biome that contains many endemic succulents. It will also provide opportunities for "Karoo" tourism and for commercial hunting of plains game, e.g. springbok (*Antidorcas marsupialis*) (Photo: G.I.H. Kerley).

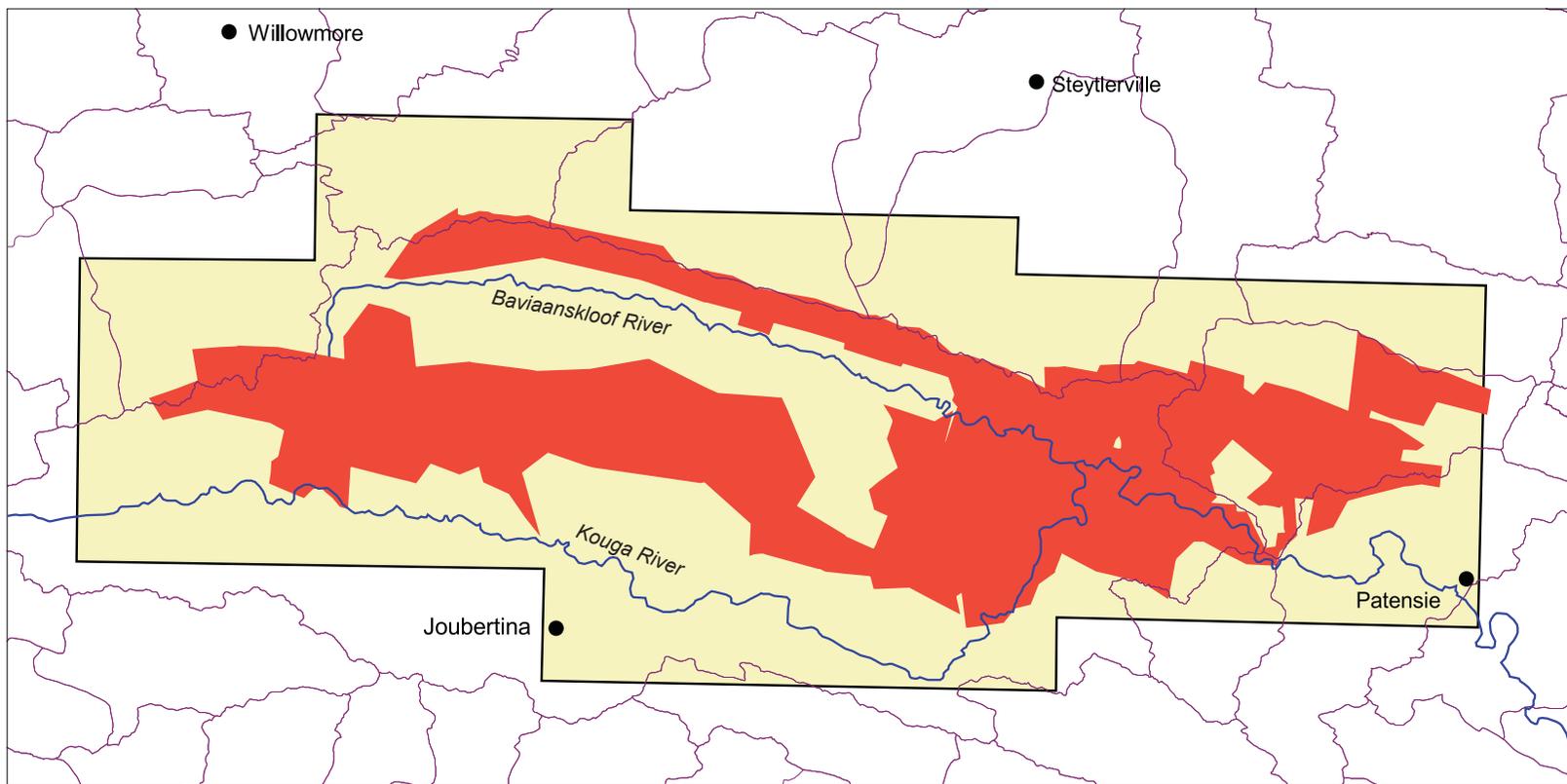
15. The boundaries of the existing Baviaanskloof Conservation Area are largely a legacy of protection for catchment management purposes. Consequently, the northern boundary of the reserve coincides mostly with the crest line of the Baviaanskloof Mountains: the northern slopes of this range yielded too little water for inclusion. However, an effective reserve system should encompass boundaries between different biological systems and span long environmental gradients. Clearly, there is a need to extend the reserve from these protea-clad slopes to the karroid plains below (Photo: R.M. Cowling).



Map 3: The Chief Directorate: Environmental Affairs (CDEA) (Eastern Cape) proposal for the consolidation and expansion of the western sector of the existing Baviaanskloof Conservation Area (Source: Chief Directorate: Environmental Affairs, Port Elizabeth).



Map 4: The eastern section of the Cape Floral Kingdom, showing the existing Baviaanskloof Conservation Area in relation to the planning outcomes of the CAPE Project. This project is an ongoing conservation planning exercise based on a grid (1/16th degree) of rectangular planning units of ca. 4000 ha each. The project recognises Mandatory Reserves as those planning units with > 50% of their area comprising statutory or non-statutory (e.g. private) reserves. Through a series of analyses of factors (e.g. species, vegetation, threats etc.), the project identifies Negotiated Reserves as those planning units which must be reserved to achieve considered conservation goals (Source: CAPE Project).



0 20 km

- Quaternary Catchment Boundaries
- Existing Baviaanskloof Conservation Area
- Planning Domain

Map 5: The planning domain for the first phase of the proposed expansion of the existing Baviaanskloof Conservation Area (see text for details). The major catchment boundaries are indicated (Source: CAPE Project and Institute for Plant Conservation).

5.1 Landscapes

The landscape diversity in the BCA is exceptionally high, owing to the region's high geological, topographic and climatic diversity. In this section we briefly outline the evolution and diversity of the landscapes, as well as the broad climatic patterns experienced there, as a background to the area's contemporary biodiversity. The reserve's geology and topography are shown in Map 6.

The BCA forms part of the Cape Folded Belt, a geomorphic province that extends from the Bokkeveld Escarpment at Nieuwoudtville in the northwest, to the Zuurberg Mountains in the east. The backbone of this province comprises the impressive peaks and ridges of the Cape Mountains, trending east-west in the southern sector, and north-south in the western sector.

The predominant rocks of the Cape Folded Belt are sediments – alternating layers of sandstone and shale known as the Cape Supergroup – that were deposited on the margins of a large inland sea between 450 and 340 million years ago, when Africa formed part of the palaeocontinent called Gondwanaland. The oldest layer in this sandwich of sediments is the Table Mountain Group, comprising predominantly the hard sandstone that form the mountains of today. All six formations of this Group are represented in the BCA, namely the (oldest) Peninsula, Cedarberg, Goudini, Skurweberg and the (youngest) Baviaanskloof. Also present, as outcrops in the valley of the Baviaanskloof River, and extensively on the karroid flats to the north of the Baviaanskloof Mountains, are Bokkeveld Group shales, another component of the Cape Supergroup. Rocks of the Witteberg Group, the youngest member of the Cape Supergroup, occur to the north of the study area, across the Steytlerville karroid flats, and forming the jagged ridges and rocky plateaux of the Groot River Heights.

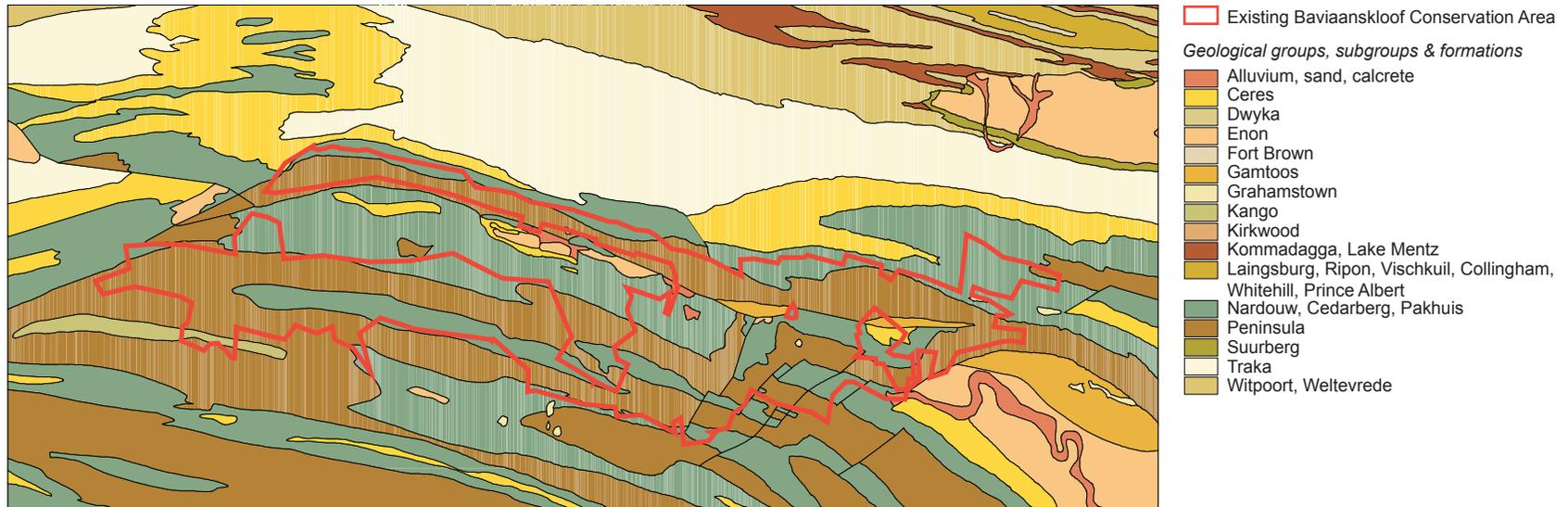
About 140 million years ago, Gondwanaland began to fragment, separating Africa from South America and opening up the Atlantic Ocean. This tectonic upheaval resulted in faulting and the formation of a number of basins, from Worcester in the west to Algoa Bay in the east. The contemporary Baviaanskloof and Gamtoos Rivers follow the course of such basins. The warm and wet conditions that ensued shortly after Gondwanaland's break up resulted in the extensive erosion of the Cape Mountains, reducing them to worn-down stumps, composed of harder quartzitic sandstone. The products of this erosion now persist in the fault basins as the Cretaceous sediments, so extensive in the Algoa and Gamtoos Basins, and represented in the Baviaanskloof by scattered deposits of reddish Enon Conglomerate.

During the early Tertiary period (65-25 million years ago), under much warmer and wetter conditions than at present, the deep weathering of the African Land Surface resulted in the formation of deep soils and gravels underlain by hardpans - ferricrete ("koffieklip") and silcrete. Exposures of these rocks are known as the Grahamstown Formation. However, minor tectonic uplift throughout the late Tertiary has resulted in the erosion of much of the deeper Tertiary soils, as well as the hard-

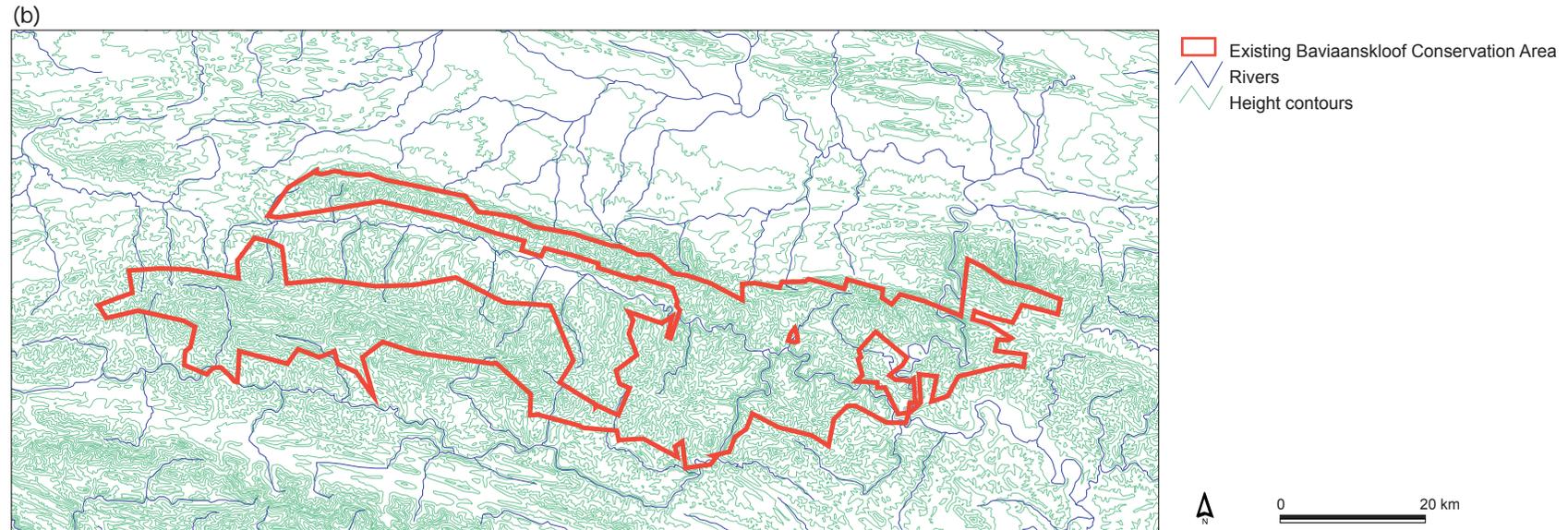


16. Between 280 and 215 million years ago, the Cape Supergroup sediments were violently folded, probably as a result of a collision between the Falkland and African tectonic plates. This folding, evident throughout the Baviaanskloof area, resulted in the partial metamorphosis of some of the sandstone layers, producing the erosion-resistant quartzitic sandstones (Peninsula and Skurweberg Formations) that dominate the contemporary scenery. Peninsula rocks form the ridges and highest peaks in the Kouga (e.g. Smutsberg: 1 757m) and Baviaanskloof (e.g. Scholtzberg: 1 625m) Mountains, whereas the Groot Winterhoek Mountains and their landmark Cockscomb peak (1 758 m), are made up of Skurweberg rocks. Seen here from a grassy shale band (Cedarberg Formation) are the distant peaks of the Cockscomb (Photo: R.M. Cowling).

pans that underlaid them. Today they are seen as reworked, gravelly sediments, often with a thinly covered stone line, although some deeper deposits have survived in places. The youngest (Quaternary: last 1.5 million years) sediments in the BCA are the alluvial deposits in the valley bottoms; these are especially extensive along the Baviaanskloof River and its major tributaries. Patches of gravels and alluvium of similar age are also found in the valleys along the northern flank of the Baviaanskloof Mountains.

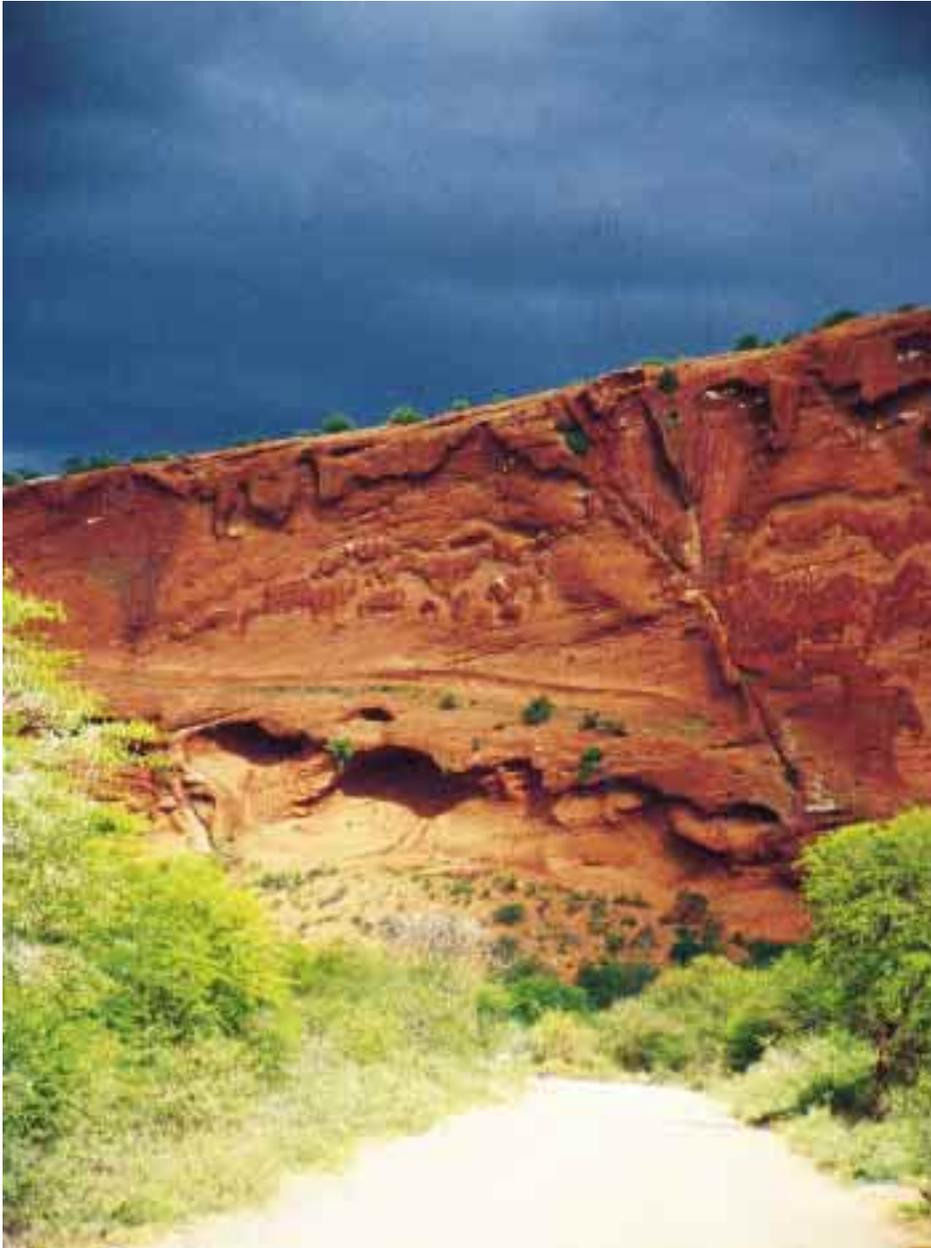


(a)



(b)

Map 6: The geology (a) and topography (as indicated by height contours) (b) of the existing Baviaanskloof Conservation Area and environs (Source: CAPE Project).



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Owing to the region's complex topography, and its location on the boundary between several climatic regimes, the climate of the BCA is very varied. Generally, summers are warm to hot, especially in the valley itself and on the karroid flats where maxima may exceed 45°C in January and February; cooler conditions, with absolute maxima of 25-30°C prevail on the upper slopes of the mountains. Absolute minima during the winter months of below 0°C are mostly experienced on the valley bottom, as a result of the drainage of cold air from the adjacent uplands. However, winter days in the mountains are generally cool to cold, especially after the passage of a westerly front. Berg winds, associated with the seawards passage of turbulent air descending from the high South African plateaux – a predominantly winter phenomenon – may result in unusually high temperatures (up to 30°C) in mid-winter.

The BCA falls within the non-seasonal rainfall zone of the Cape Kingdom. Although rain may fall in all parts of the region in any month of the year, there are some clear patterns in the season and amount of rainfall across the region. The wettest areas are the uplands of the western Kouga Mountains which receive in excess of 1 000 mm per year, as do those of the eastern Baviaanskloof and Groot Winterhoek Mountains. Being in the shadow of the mountain peaks, the lower slopes and plateaux are relatively dry, receiving between 300 and 600 mm per year. The driest regions are the valley bottom (200–250 mm) and the karroid flats (100–200 mm). Overall, the moisture gradients in the Baviaanskloof are very steep.

At least four different climatic regimes bring rain to the BCA. Westerly frontal systems, which peak in the winter months, bring rain (and sometimes snow) to the higher ground, especially the western Kouga Mountains and the eastern Baviaanskloof and Groot Winterhoek ranges. All of the uplands, but especially those in the east that face directly towards the coast, can receive soft, soaking rain after the passage of such fronts, when moist air is advected by southerly and south-easterly winds across the warm Indian Ocean. The frequency of these events is greatest in the spring and autumn months. Cut-off lows, when frontal depressions are trapped inland by a high-pressure cell ridging along the coast, bring rain to the entire Baviaanskloof region, including the karroid flats. These relatively unusual events, which draw in moisture from the coast as well as from the interior, are most frequent in spring and autumn. Finally, unstable "thunderstorm" conditions bring rain (and fire-igniting lightning) to the mountains in late summer. These conditions

are the major source of rain for the karroid flats. Generally, therefore, rainfall peaks in autumn and spring. Invariably, mid-summer is the driest period, and, owing to the high temperatures experienced then, it is the time when the region's ecosystems are under greatest stress.

In summary, the Baviaanskloof encompasses a wide diversity of landscapes and, as we shall see in the following sections, these landscapes support an even greater diversity of ecosystems.

5.2 Plant life

Flora

The flora of the existing BCA is fairly typical of floras from throughout the Cape Kingdom, as shown by the importance of families such as the Ericaceae, Proteaceae, Iridaceae, Rutaceae and Mesembryanthemaceae (Table 1). Indeed, the composition of the flora is not dissimilar from that of the Cederberg area, a mountainous region in the northwestern part of the Cape Kingdom (see Table 1). Both areas boast large numbers of species of typical Cape Kingdom genera such as *Agathosma*, *Aspalathus*, *Crassula*, *Erica* and *Pelargonium*. In our discussion of the flora, we shall focus on a comparison with the flora of the Cederberg, another large conservation area in the Cape Kingdom that has also been proposed as a mega reserve by the CAPE Project.

At 1 161 species, albeit an incomplete list, the BCA flora is very rich. However, when standardized for area, the flora is poorer than those from the mountainous landscapes of the western, winter rainfall parts of the Cape Kingdom. Studies have shown that similar landscapes harbour, on average, 2.5 times as many species as those in the east. This is largely the result of a much lower incidence of rare species in the eastern landscapes. Interestingly, in terms of plant species, the BCA flora ranks as one of the richest in the east; thus, when standardized for area, the flora of the Cederberg is only 1.65 times richer than that of the BCA.

Although the Cederberg has more species than the BCA, these species are concentrated in fewer genera and families (Table 1). The BCA includes 147 more genera, and 38 more families than the Cederberg. Thus, at the supraspecific level, the flora of the BCA is extremely rich. While the western floras include numerous clusters of closely related species, the BCA flora encompasses a much greater range of genetic diversity. These include the genetically distinct and very ancient cycads (Zamiaceae) as well as many families and genera commonly associated with the more subtropical parts of southern Africa (e.g. Acanthaceae, Apocynaceae, Araliaceae, Bignoniaceae, Capparaceae, Dracaenaceae, Icacinaceae, Lauraceae, Oliniaceae, Meliaceae, Piperaceae, Pittosporaceae, Ptaeroxylaceae, Salvadoraceae, Sapotaceae, Tiliaceae, *Loxostylis* (Anacardiaceae), *Dovyalis* (Flacourtiaceae), *Scutia*, *Rhamnus* (Rhamnaceae), *Canthium*, *Pavetta*, *Psydrax*, *Rothmannia* (Rubiaceae), *Calodendron*, *Clausena*, *Teclaea*, *Vepris*, *Zanthoxylum* (Rutaceae), *Allophylus*, *Atalaya*, *Smelophyllum* (monotypic endemic) and *Hippobromus* (Sapindaceae).

17. The impressive valley of the Baviaanskloof River, seen here on the western descent from Bergplaas, was formed about 140 million years ago as a result of the fragmentation of Gondwanaland (Photo: R.M. Cowling).

18. The reddish deposits of pebbles in a sandy matrix, known as the Enon Conglomerates, were deposited in the Baviaanskloof fault valley during the warm and wet Cretaceous period. These deposits, the products of the erosion of most of the softer sediment in the Cape Supergroup rocks, have been mostly stripped away. Remnant patches, however, can be seen along the entire length of the Baviaanskloof valley (Photo: R.M. Cowling).

19. The post-Gondwanan erosion produced a series of plateaux, termed the African Land Surface, that are evident throughout the Baviaanskloof Conservation Area today at altitudes of between 650 and 900m. These gently sloping surfaces are mostly underlain by the softer sediments of the Table Mountain Group, principally the brownish rocks of the Goudini Formation. The plateaux have deeper, finer-grained and more fertile soils than those derived from the harder Peninsula and Skurweberg sandstones of the adjacent peaks (Photo: R.M. Cowling).

Table 1. Numbers and cumulative percentages of species in the 10 largest genera and the 10 largest families in the existing Baviaanskloof Conservation Area (1 780 km²) and the Cederberg (1 260 km²) floras. Abbreviations: spp. = species, gen. = genera; fam. = families

Baviaanskloof Conservation Area			Cederberg		
Totals: spp. = 1161; gen. = 556; fam. = 135			Totals: spp. = 1778; gen. = 409; fam. = 97		
	No. spp	Cum. %		No. spp	Cum. %
Genera			Genera		
<i>Erica</i>	45	3.9	<i>Erica</i>	83	4.7
<i>Crassula</i>	39	7.2	<i>Aspalathus</i>	54	7.7
<i>Pelargonium</i>	28	9.6	<i>Agathosma</i>	41	10.0
<i>Aspalathus</i>	17	11.1	<i>Pelargonium</i>	34	11.9
<i>Senecio</i>	17	12.6	<i>Crassula</i>	30	13.5
<i>Hermannia</i>	16	13.9	<i>Pentaschistis</i>	28	15.2
<i>Protea</i>	15	15.2	<i>Phyllica</i>	27	16.7
<i>Agathosma</i>	14	16.4	<i>Oxalis</i>	26	18.2
<i>Euphorbia</i>	14	17.7	<i>Senecio</i>	25	19.6
<i>Haworthia</i>	12	18.7	<i>Ficinia</i>	24	20.9
Families			Families		
Asteraceae	124	10.7	Asteraceae	238	13.4
Fabaceae	66	16.4	Iridaceae	139	21.2
Poaceae	59	21.4	Fabaceae	126	28.3
Ericaceae	52	25.9	Ericaceae	100	33.9
Crassulaceae	51	30.3	Restionaceae	87	38.8
Iridaceae	39	33.7	Scrophulariaceae	83	43.5
Asphodelaceae	37	36.9	Rutaceae	70	47.4
Mesembryanthemaceae	33	39.7	Poaceae	69	51.2
Proteaceae	33	42.5	Cyperaceae	67	54.9
Rutaceae	29	45.6	Proteaceae	52	57.8

Indeed, the flora of the BCA has relatively strong links with those of the mesic summer-rainfall areas, especially the coastal forests of the Indian Ocean Belt and the temperate, Afromontane grasslands of the Drakensberg uplands. This transitional nature contributes strongly to the high genetic diversity of the flora. The expanded conservation area proposed here would also include a number of Nama-karoo genera and species that are not normally found in Cape Kingdom landscapes. Of particular significance are at least 70 succulent species, including many species of *Crassula*, *Haworthia*, *Euphorbia* and *Ruschia*.



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20. Some 15 species of *Protea* grow in the Baviaanskloof Conservation Area. Shown here is water sugarbush (*P. punctata*) (Photo: R.M. Cowling).
21. Two species of cycad – survivors from an ancient era – grow in the Baviaanskloof area. This species, *Encephalartos longifolius*, must have witnessed great changes in climate and vegetation during its occupancy of this area (Photo: R.M. Cowling).
22. The karroid vegetation to the north of the existing reserve harbours a rich succulent flora, including many local endemics. Shown here in its characteristic shale habitat is the cryptic stone plant (*Lithops terricolor*) (Photo: R.M. Cowling).
23. *Gladiolus geardii* is a relatively rare bulb confined to shady sites and streambanks in the Baviaanskloof, Kouga, Elandsberg and Groot Winterhoek Mountains of the eastern Cape Floral Kingdom. This handsome specimen is growing alongside the Outeniqua yellowwood (*Podocarpus falcatulus*) on the banks of the Witte River (Photo: R.M. Cowling).
24. The steeply incised kloofs or canyons in the reserve support a rich flora of cliff-loving species, a few of which grow nowhere else. Included among these endemics is *Stapelia baylissii*, showing the "hanging garden" growth form typical of many plants specialized for cliff dwelling (Photo: R.M. Cowling).
25. The forest vegetation comprises an interesting mix of trees of temperate and tropical affinity. The early foliage of the white stinkwood (*Celtis africana*), a winter-deciduous species widespread in southern Africa's subtropical forests, heralds the onset of spring (Photo: R.M. Cowling).
26. The Baviaanskloof Conservation Area continues to yield species unknown to science. Shown here is an undescribed species of *Pelargonium* from the northern slopes of the Kouga Mountains. Many of the higher peaks have yet to be explored by naturalists (Photo: R.M. Cowling).

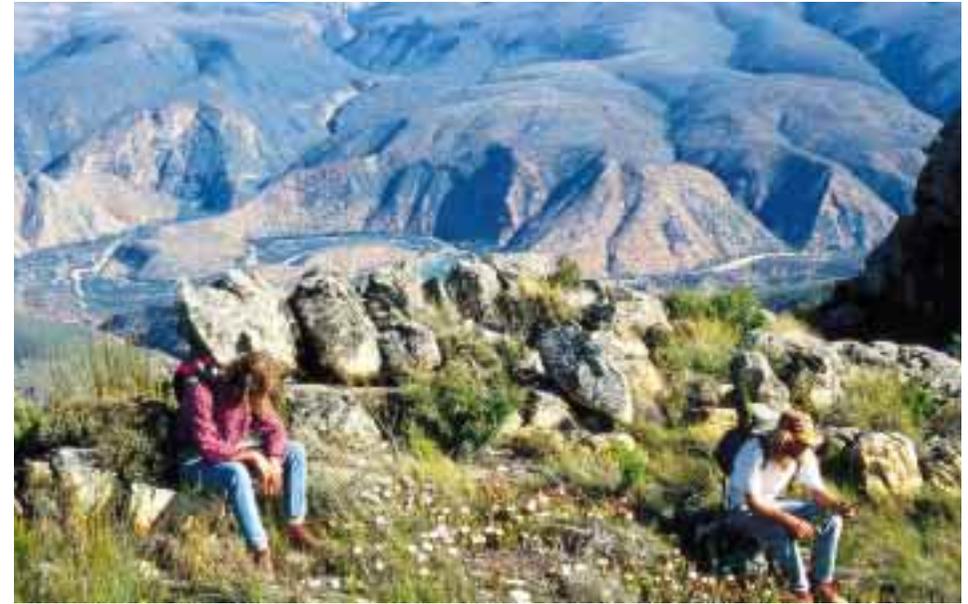
The incidence of rare and endemic species is exceptionally high by global standards. Thus, at least 52 species in the existing conservation area are listed Red Data Book taxa, whereas 20 species are currently known to be endemic to the region. These figures will be considerably higher for the expanded conservation area proposed in this document.

Vegetation

Owing to the great diversity of landscapes, the BCA and close environs support a great diversity of vegetation types (Map 7; Table 2). The expanded conservation area proposed here will include 12 major vegetation types representative of six of South Africa's seven biomes. Thus, diversity for this conservation area at the ecosystem scale is extraordinarily high, paralleled only by the proposed Greater Addo National Park (GANP).

The significance of this juxtaposition of different ecosystems is extremely important. Within the boundaries of a single conservation area are included an almost complete spectrum of pattern and process of the diverse southern African region. Fire-prone fynbos shrublands exist side-by-side with bulk grazer-driven grasslands, megaherbivore-maintained thicket and browser-controlled savanna. Protected valleys support functionally distinct forest ecosystems while the karroid plains to the north support semi-arid shrublands where nomadic herds of medium-sized grazers and periodic drought are the principle selective forces. Nowhere else in the Cape Kingdom is it possible to find such an extraordinarily diverse array of functionally different vegetation types and associated ecosystems.

Rather than provide a description of each of the BCA vegetation types, we summarize the salient features in Table 2 and in expanded captions to Plates 27-36.



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27. The higher (> 1400 m) peaks of the Baviaanskloof Conservation Area, which are frequently snow-covered in winter, support a short form of fynbos called alpine fynbos, such as here on the Scholberg (Photo: D. Euston-Brown).

28. Mesic fynbos, shown here in the eastern reaches of the reserve above Patensie, occupies the wetter and more shaded slopes of the reserve. The prominent shrub in the foreground is the narrow-leaf sugarbush (*Protea neriifolia*) (Photo: R.M. Cowling).



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29. Restioid fynbos, dominated by the reed-like restio family, is associated with poor, sandy soils and exposed slopes at high altitudes (Photo: R.M. Cowling).

30. Grassy fynbos is found on drier, lower slopes and on relatively wet plateaux, especially in the eastern reaches. The reserve supports many forms of grassy fynbos, including this community of the grass *Pentaschistis eriostoma* (foreground) and *Erica pectinifolia* (background) on shallow sand derived from quartzite (Photo: R.M. Cowling).

31. In the wet, eastern sector of the reserve, the shale band (Cedarberg Formation) supports a grassland that is similar in all respects to the upland sourveld of the summer-rainfall Drakensberg escarpment. Here a red-hot poker (*Kniphofia* sp.) grows amongst summer-active grasses such as *Elionurus muticus*, *Harpochloa falx* and *Trachypogon contortus* (Photo: R.M. Cowling).

32. In the drier, western parts of the reserve, the African Land Surface supports vegetation types that cannot be classified as fynbos. An example is *Pteronia*/renosterveld, a complex community associated with deepish, fine-grained soils, with floral affinities to most of southern Africa's biomes. The blueish-coloured shrub in the grassy matrix is bloubos (*Pteronia incana*) (Photo: R.M. Cowling).



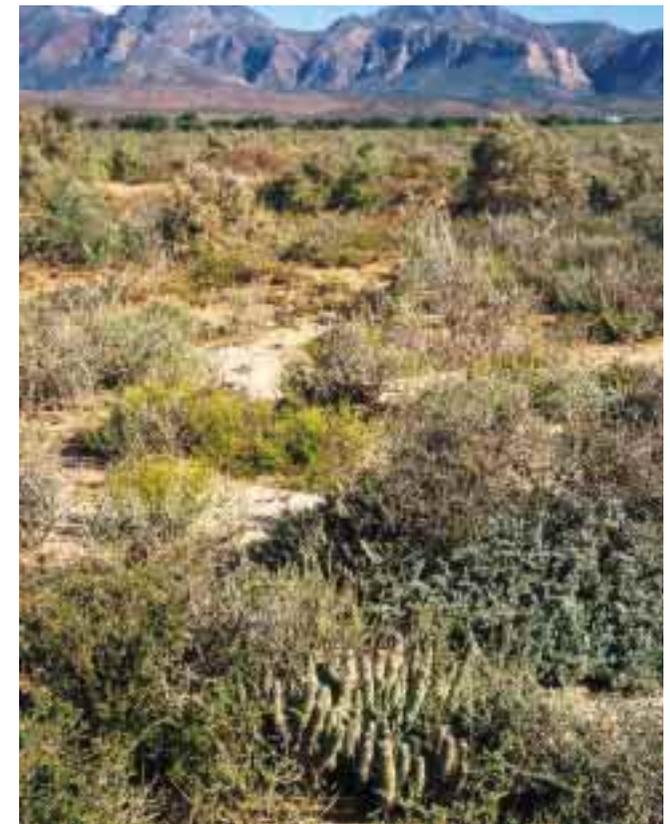
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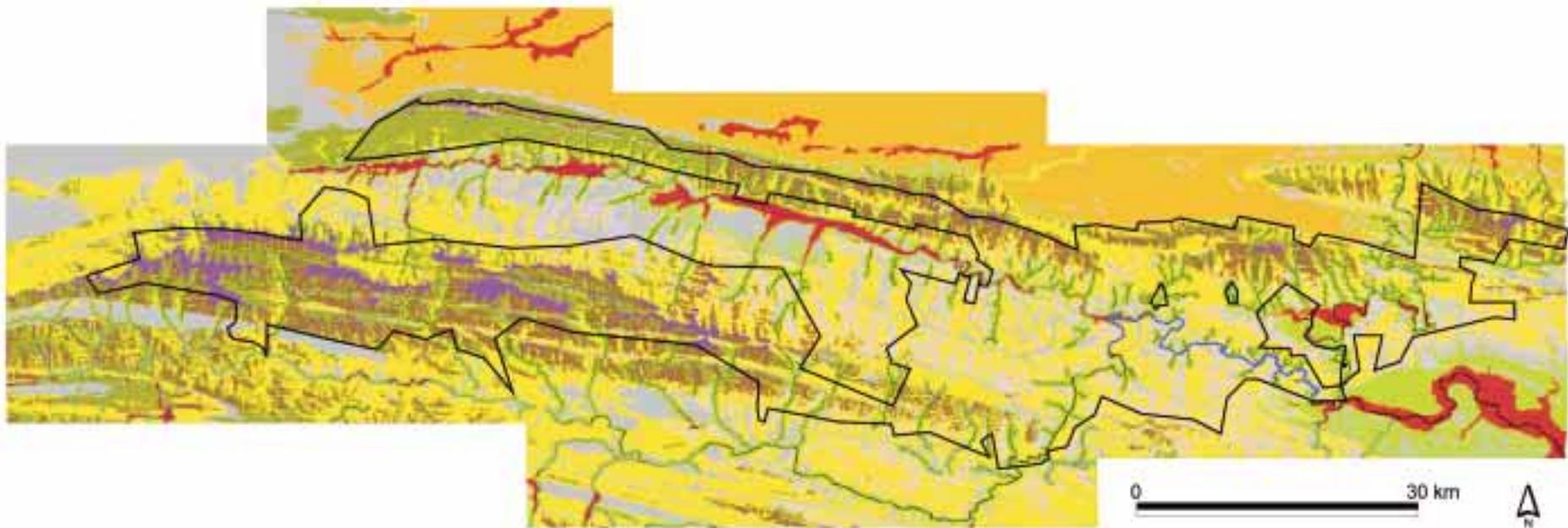
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33. Succulent thicket, a vegetation that is characteristic of the thicket biome, is well represented in the Baviaanskloof Conservation Area. The dynamics of the palatable vegetation was almost certainly controlled by large browsing mammals, including African elephant and black rhinoceros that have sadly been extirpated from the area. Succulent thicket occupies the relatively fertile and deep soils of the lower slopes and valley walls (Photo: R.M. Cowling).

34. Most streamside in the region support some form of forest vegetation. Here the tropical Cape fig (*Ficus sur*) and white stinkwood (*Celtis africana*) coexist with the temperate Outeniqua yellowwood (*Podocarpus falcatus*) (Photo: R.M. Cowling).

35. Bottomland savanna, a relatively simple community dominated by sweet thorn (*Acacia karroo*), is associated with alluvial soils of the valley bottom, the most fertile areas of the reserve. It is not surprising, therefore, that this vegetation type has been extensively replaced by agriculture. Fortunately, the savanna is resilient and soon recovers after clearing. Shown here is a regenerating savanna along the lower reaches of the Baviaanskloof River (Photo: D. Euston-Brown).

36. Karroid broken veld occupies the flats to the north of the reserve. This desert-like vegetation is home to many small succulent species, including *Euphorbia esculenta* shown in the foreground (Photo: R.M. Cowling).



Vegetation Types

Mountain fynbos

- alpine fynbos
- mesic fynbos
- restioid fynbos
- grassy fynbos

Transitional shrubland

- Passerina* veld
- Pteronia/renosterveld* & grassland

Succulent thicket

- succulent thicket

Savanna

- bottomland savanna

Forest

- forest

Karoo

- karroid broken veld

Map 7: The vegetation of the planning domain for an expanded Baviaanskloof Conservation Area (Source: D. Euston-Brown, in association with Computamaps, and Institute for Plant Conservation).

Table 2. Major vegetation types of the Baviaanskloof Conservation Area. See Map 7 for distribution and Plates 27-36 for additional information.

Vegetation type	Biome	Landscape correlates	Indicator species
Mountain fynbos			
alpine fynbos	fynbos	Quartzitic peaks > 1400 m	<i>Elegia juncea</i> , <i>Erica nabea</i> , <i>Hypodiscus albo-aristatus</i> , <i>Protea mundii</i> , <i>Simocheilus fourcadei</i>
mesic fynbos	fynbos	Steep, quartzitic south slopes and seepage areas	<i>Cannomois virgata</i> , <i>Elegia juncea</i> , <i>E. vaginulata</i> , <i>Erica nabea</i> , <i>Hypodiscus albo-aristatus</i> , <i>H. aristatus</i> , <i>Leucadendron eucalyptifolium</i> , <i>L. uliginosum</i> , <i>Protea mundii</i>
restioid fynbos	fynbos	Exposed ridges and north slopes on quartzitic rocks	<i>Brachiaria serrata</i> , <i>Cannomois scirpoides</i> , <i>Elegia juncea</i> , <i>E. vaginulata</i> , <i>Erica nabea</i> , <i>Hypodiscus albo-aristatus</i> , <i>H. aristatus</i> , <i>Leucadendron uliginosum</i> , <i>Mastersiella purpurea</i>
grassy fynbos	fynbos/grassland	Lower mountain slopes and African Land surface, mostly associated with Goudini sandstone	<i>Aspalathus collina</i> , <i>Brachiaria serrata</i> , <i>Cliffortia drepanoides</i> , <i>Diosma prama</i> , <i>Disparago ericoides</i> , <i>Erica demissa</i> , <i>E. pectinifolia</i> , <i>Hypodiscus striatus</i> , <i>Ischyrolepis gaudichaudiana</i> , <i>Leucadendron salignum</i> , <i>Leucospermum cuneiforme</i> , <i>Merxmuellera arundinacea</i> , <i>Pentaschistis eriostoma</i> , <i>Pteronia teretifolia</i> , <i>Rhodocoma fruticosa</i> , <i>Senecio oliganthus</i>
Transitional shrublands			
<i>Passerina</i> veld	fynbos/succulent karoo	Dry, rocky sandstone soils, mostly at the margin of plateaux	<i>Aloe ferox</i> , <i>Elytropappus rhinocerotis</i> , <i>Phyllica axillaris</i>
<i>Pteronia</i> /renoster-veld	fynbos/succulent karoo	Same general locality as above but with a greater depth of residual soil	<i>Aloe ferox</i> , <i>Elytropappus rhinocerotis</i> , <i>Pteronia incana</i> , <i>Passerina obtusifolia</i>
grassland	grassland/fynbos	Deep, shale-derived or residual soils on African Land Surface	<i>Aloe ferox</i> , <i>Elytropappus rhinocerotis</i>
Succulent Thicket			
mesic succulent thicket	thicket	Lower, colluvial valley slopes and kloofs in the Baviaanskloof River valley, east of Studtis	<i>Aloe speciosa</i> , <i>Euphorbia grandidens</i> , <i>Schotia latifolia</i>
xeric succulent thicket	thicket/succulent karoo	Lower, colluvial valley slopes and kloofs in the Baviaanskloof River valley, west of Studtis	<i>Grewia robusta</i> , <i>Pappea capensis</i> , <i>Portulacaria afra</i> , <i>Putterlickia pyracantha</i>
Savanna			
bottomland savanna	savanna	Alluvial bottomlands	<i>Acacia karroo</i> , <i>Cynodon dactylon</i>
Forest			
forest	forest	Deep kloofs along perennial streams	<i>Celtis africana</i> , <i>Ficus sur</i> , <i>Vepris lanceolata</i> , <i>Podocarpus falcatus</i> , <i>Virgilia divaricata</i>
Karoo			
karroid broken veld	Nama-karoo/succulent karoo	Stony shale plains and ridges of the arid karroid flats	<i>Drosanthemum lique</i> , <i>Eragrostis chloromelas</i> , <i>Euclea undulata</i> , <i>Euphorbia esculenta</i> , <i>Pappea capensis</i> , <i>Pentzia incana</i> , <i>Rosenia humilis</i>

5.3 Animal life

Southern and south-western South Africa is recognised as a region of high faunal biodiversity, and high endemism. The existing BCA is somewhat on the fringes of this faunal hotspot, although, as indicated below, it nonetheless has an exceptionally rich fauna. In addition, many species show disjunct distributions, with populations recorded in the south-western Cape and in the eastern highlands, but which are absent in between. The BCA and close environs lies within these distribution gaps, despite the fact that suitable habitat appears to be present in this area. It is therefore highly probable that these species do occur here, but have been overlooked due to poor sampling effort. If correct, this hypothesis suggests that the faunal biodiversity of the BCA and adjacent areas is even richer and more interesting than has been documented to date, and that additional biological survey work is required.

Two major factors contribute to the area having an exceptionally rich and interesting fauna: these are the degree of habitat complexity provided by the combination of landscapes, geology, climate and flora, as well as the fact that the region has provided a relatively stable refuge for the persistence of palaeoendemic species. This fauna has however been placed under severe pressure in recent years due to human activities, primarily through direct exploitation, habitat transformation and the introduction of alien species. Many faunal species, particularly of large mammals, have been extirpated from the region, but the potential for their re-establishment from other populations does exist.

Mammals

An expanded BCA will provide habitat for 46 medium- and large-sized mammal species (excluding rodents, bats and insectivores). These represent almost the full complement of mammals that occurred naturally within the Cape Kingdom, only bontebok (*Damaliscus dorcas dorcas*) being absent. Within the last 300 years, 14 species have been extirpated. Four species (Cape mountain zebra, red hartebeest, Cape buffalo and eland) have been re-introduced in the last decade, while another species (brown hyaena *Hyaena brunnea*) has been recorded intermittently, though these sightings probably represent vagrant individuals.

The reintroduction of the three missing members of the Big Five (lion, leopard, African elephant) would be conditional upon the provision of appropriate habitat (see Box 4) and management (especially fencing and security aspects). Lion would require extensive karoo habitat to the north in the Steytlerville basin or the valley bottom within the Baviaanskloof. Black rhinoceros could utilise these habitats as well as the thicket habitat, in the east of the area, which would also support African elephant. These species are important not only for their intrinsic value, but also for the ecological processes which they drive (predation by lion and leopard, or herbivory by the megaherbivores). In addition, the Big Five are essential assets for the tourism development option. An expanded BCA represents the only area within the Cape Kingdom that could potentially support the Big Five, and also the closest opportunity to the Western Cape tourism node.

Other extirpated species which could be re-introduced include spotted hyaena (*Crocuta crocuta*), cheetah (*Acinonyx jubatus*), serval (*Felis serval*), African wild dog (*Lycaon pictus*), zebra (*Equus burchelli*), gemsbok (*Oryx gazella*) and hippopotamus



37. Historical records of the large mammal fauna of the Baviaanskloof Conservation Area include all members of the Big Five (lion *Panthera leo*, leopard *P. pardus*, African elephant *Loxodonta africana*, Cape buffalo *Syncerus caffer* and black rhinoceros *Diceros bicornis*), but only two species occur currently: leopard and buffalo. The landscapes of an expanded reserve will enable the reintroduction of the remaining three species (Photo: G.I.H. Kerley).

(*Hippopotamus amphibius*). These species would require specific management; suitable habitat is, however, available in the reserve and adjacent areas. Their reintroduction, together with the reintroduction of the three missing elements of the Big Five, would restore the natural large mammal fauna to the region, providing all the elements for a naturally functioning ecosystem, as well as the southernmost location for the African big game species.

Box 4: Large and megaherbivores in the Baviaanskloof Conservation Area

To enable an expanded BCA to carry populations of the large herbivores (Cape buffalo) and the megaherbivores (African elephant, black rhinoceros) it is imperative that the entire floor of the Baviaanskloof, and a section of the karroid flats to the north of the Baviaanskloof Mountains, be acquired and incorporated into the reserve.



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38. An expanded Baviaanskloof Conservation Area will provide a secure refuge for a population of the leopard (*Panthera pardus*), one of Africa's Big Five and a Red Data Book species that is in urgent need of protection in many parts of its range in southern Africa (Photo: P.M. Norton).

39. The thicket and riparian vegetation of the reserve supports a substantial population of the kudu (*Tragelaphus strepsiceros*), a medium-sized browsing herbivore that has a relatively restricted range in South Africa (Photo: C. Urquhart).

The small mammal diversity within the area is relatively high, representing a combination of savanna and fynbos species. There are strong links with the small mammal fauna of the summer rainfall regions, especially the grasslands of the Drakensberg highlands. Verreaux's mouse (*Praomys verreauxii*) is a fynbos endemic recorded within the BCA, while the expanded BCA proposed here would probably include the only karoo regional endemic, Grant's rock mouse (*Aethomys grantii*).

Birds

The bird diversity is noteworthy, comprising 310 recorded species, which is more than a third of the total bird fauna in South Africa. The BCA is recognised as a Globally Important Bird Area on account of the high overall diversity of birds, the presence of Globally threatened species (blue crane *Anthropoides paradisea*, lesser kestrel *Falco naumanni*), Globally near-threatened species (black harrier *Circus maurus*, ground woodpecker *Geocolaptes olivaceus*, Cape rockjumper *Chaetops frenatus*, Cape siskin *Serinus totta*, protea canary *Serinus leucopterus*) and Nationally threatened (African marsh harrier *Circus ranivorus*, striped fluff-tail *Sarothrura affinis*, Stanley's bustard *Neotis denhami*) and near-threatened species (black stork *Ciconia nigra*, peregrine falcon *Falco peregrinus*, lanner falcon *Falco biarmicus*), as well as the fact that all of the Cape Kingdom restricted bird species occur here. These include Victorin's scrub warbler (*Bradypterus victorini*), Cape sugarbird (*Promerops cafer*), orange-breasted sunbird (*Nectarinia violacea*), Cape rockjumper (*Chaetops frenatus*), Cape siskin (*Serinus totta*), and protea canary (*Serinus leucopterus*).

A number of large raptors, which are persecuted by farmers for alleged stock losses, find refuge within the BCA. These include booted eagle (*Hieraaetus pennatus*), crowned eagle (*Stephanoaetus coronatus*), black eagle (*Aquila verreauxii*), fish eagle (*Haliaeetus vocifer*) and martial eagle (*Polemaetus bellicosus*); these are the avian equivalent of the Big Five.

Reptiles

Remarkably, almost half (23 species) of the 56 reptile species recorded in the BCA are endemic to South Africa. This degree of endemism is further highlighted by the fact that 10 of these species are recognised as Cape endemics, of which three species have only ever been recorded within the BCA and environs. Many new reptile species are currently being described in South Africa. Those regions that have been relatively poorly surveyed and which are ecologically diverse, such as the BCA, are yielding many new findings of species.

Amphibians

The BCA amphibian fauna includes 17 species, which is high by global standards, and reflects the fact that South Africa has a particularly rich amphibian fauna. This group is, however, recognised as being poorly studied, and more species are being discovered. The BCA is not an exception in this regard and it is probable that more species do occur here.

Fish

At 15 species, the indigenous fish fauna of the BCA is exceptionally high by South African standards. Most of these species belong to the Southern Temperate fauna, possibly representing Gondwanan palaeoendemics. For example the closest living



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40. The Baviaanskloof Conservation Area chelonian (tortoises and turtles) diversity of four species approaches the national maxima of five species in sympatry. It is possible that the proposed expansion of the reserve into the karoo will include habitat of the karoo parrot-beaked tortoise (*Homopus boulengeri*), while the southwards extension will include habitat of the parrot-beaked tortoise (*H. areolatus*). This would increase the potential number of chelonians in the reserve to six species, including the leopard tortoise (*Geochelone pardalis*) (Photo: G.I.H. Kerley).

41. Of the amphibian species recorded in the area, four are recognised as fynbos endemics. Most notable are a number of ghost frog (*Heleophryne*) species, which represent palaeoendemics; at least one species is endemic to the area. Members of this South African endemic family of frogs have managed to persist over a considerable period, and have very specific habitat requirements of clear montane streams (Photo: W.R. Branch).

42. A matter of concern is the fact that six species of fish have been introduced into the reserve, including the predatory bass species (*Micropterus* sp.). These are considered to represent major threats to the indigenous fish, such as the threatened redfin minnow (*Pseudobarbus afer*) shown here (Photo: J. Cambrey).

relatives of Cape galaxius's (*Galaxias zebratus*) occur in southern Chile, another Gondwanan remnant. Two species of redfin minnow (*Pseudobarbus afer* and *P. asper*) recorded in the BCA are threatened, and the area has been identified as a key area for the future conservation of these species.

Invertebrates

The invertebrate fauna has been poorly studied, but the limited information suggests a very high degree of endemism. For example, five of the 19 recorded fruit chafer beetles (family Cetoniinae) are Cape endemics, as are six of the nine cicadas (one species of each being endemic to the BCA) and environs. To date, 55 butterfly species have been recorded, of which two species are listed as threatened, and one genus (*Thestor*) is considered to be so closely associated with fynbos as to represent a "Capensis element". The high degree of endemism among the invertebrates reflects the fact that the area is one of high palaeoendemism. It appears that many groups of invertebrates have persisted here since the break-up of the Gondwanaland supercontinent over 100 million years ago. This persistence has

been attributed to the relative stability, both geologically and climatically, of this region over this period. Furthermore, the montane habitats provided microclimatic refugia, allowing temperate species to persist in the face of climate change. Important invertebrate palaeoendemics are found amongst the snails and slugs (Mollusca), harvestmen (Opiliones: Triaenonychidae), flies (Diptera), alderflies and dobsonflies (Megaloptera), earwigs (Dermaptera), plant bugs (Homoptera: Cicadellidae) caddisflies (Trichoptera) and stoneflies (Plecoptera). Amongst the beetles (Coleoptera), the stagbeetles (*Colophon* spp.) are recognised as being restricted to montane fynbos habitats.

Many of these palaeoendemics are aquatic or have aquatic life phases. This emphasises the need for effective conservation management of the streams and wetlands. These habitats are currently threatened by incompatible land-use practices (water extraction, channelization of flow, eutrophication, etc.) and are also extensively invaded by alien plants and fish. Many of the alien fish prey on these palaeoendemic invertebrates, amphibians and fish. The proposed expanded BCA would therefore make a significant contribution towards the successful conserva-

tion of this important component of South Africa's biodiversity.

5.4 Processes

A major goal for an expanded BCA is to conserve not only the patterns of biodiversity (species and habitats) but also the processes that maintain and produce these patterns. The intention is, therefore, to design a conservation area that will continue to function ecologically indefinitely, and will continue to sustain evolutionary processes that will result in ongoing speciation of both plants and animals. In short, the aim is to identify a conservation area that will have an evolutionary future.

To plan for an evolutionary future is not an easy task. An important step is to list all of those processes – both ecological and evolutionary – that must be incorporated to sustain biodiversity patterns. The next step is to identify the spatial components of these processes as features (minimum areas of habitat, gradients, corridors, etc.) that can be represented on a map. The third step is to set targets for these spatial components (how many gradients or corridors are required?). Finally, these targets must be achieved by designing an appropriate conservation system.

The processes and their spatial components required for an expanded BCA are listed in Table 3, and some are illustrated in Plates 43-48. This list is preliminary and it is possible that an expanded reserve (see Map 5) may not be able to accommodate all of them. Ultimately, the boundaries of the BCA will have to be expanded further in order to incorporate the requisite area for all processes, especially as knowledge of these requirements increases. Nonetheless, the delimitation shown in Map 5 is a marked improvement over the existing conservation area in terms of process conservation. As can be seen in Table 3, the inclusion of the entire Baviaanskloof River catchment, the extension northwards into the karroid basin and the extension southwards to the banks of the Kouga River incorporates land that greatly extends environmental gradients and provides additional habitat necessary for the maintenance of the full spectrum of plant-herbivore processes, as well as affording greater resilience to the impacts of climate change.



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43. The incorporation into the Baviaanskloof Conservation Area of juxtaposed ecosystems that differ fundamentally in their structural and functional characteristics, provides a measure of resilience to climate change. Here a karroid community, dominated by the succulent *Euphorbia atrispina*, is poised to colonise the area vacated by succulent thicket on the background slopes should the climate become drier in the future (Photo: R.M. Cowling).

44. The inclusion of the entire catchment of the Baviaanskloof River in an expanded reserve will conserve an entire hydrological system and its associated processes, as well as ensure the delivery of clean water, a valuable ecosystem service (Photo: R.M. Cowling).

45. An expanded reserve will not only conserve a great diversity of species and ecosystems, but also the processes that support and generate these biodiversity patterns. Thus, it should be possible to maintain a natural fire regime throughout the reserve. Not only will this ensure that an important ecological and evolutionary force, namely fire, operates as naturally as possible, but it will also reduce the costs of management substantially. Here a wildfire, spreading from the Langkloof, billows smoke across the Kouga Mountains (Photo: R.M. Cowling).



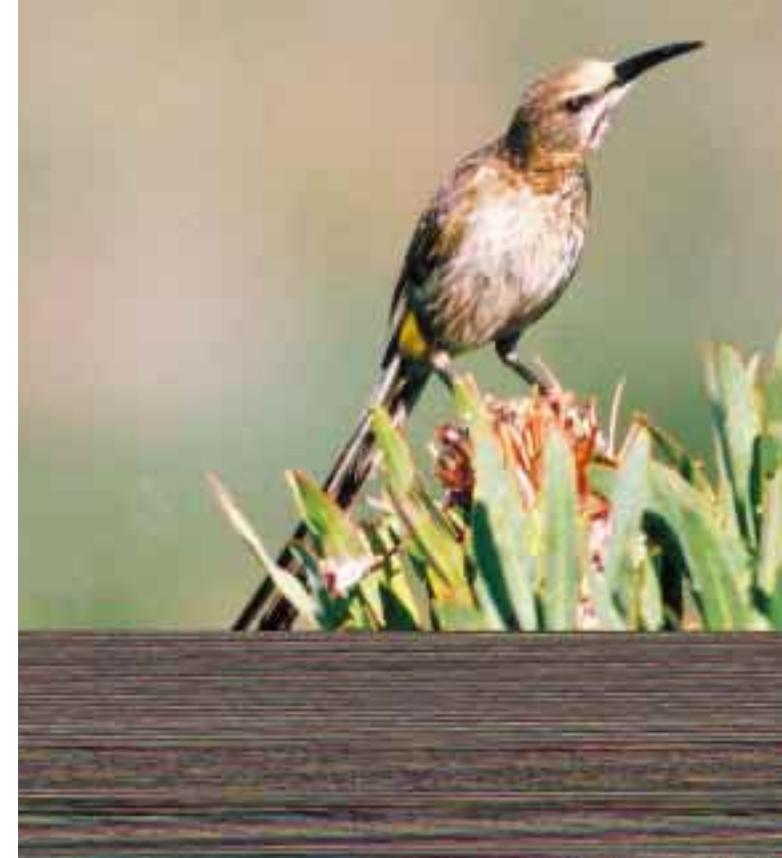
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46. An expanded Baviaanskloof Conservation Area should have a size and configuration capable of maintaining all of the processes necessary to ensure the long-term persistence of biodiversity in the mountain landscapes of the eastern Cape Floral Kingdom (Photo: R.M. Cowling).

47. Herbivory is an important ecological process in the reserve. For this reason the reserve should be expanded to enable it to support populations of large herbivores (e.g. Cape buffalo *Syncerus caffer*) and megaherbivores (e.g. African elephant *Loxodonta africana* and black rhinoceros *Diceros bicornis*) (Photo: G.I.H. Kerley).

48. Pollination is an important process for the maintenance of biodiversity in the area. The Cape sugarbird (*Promerops cafer*), a fynbos endemic, is one of the species that fulfils this role (Photo: T.H. Woolridge).

Table 3. The ecological and evolutionary processes necessary for biodiversity maintenance and generation, and the corresponding spatial components of natural habitat that will be encompassed by an expanded Baviaanskloof Conservation Area.

Process	Spatial components (natural habitat)
Specialist pollinator relationships	Small (5-1000 ha) fragments
Regular, whole-patch fires	Small (ca 500-1000 ha) fragments
Plant-herbivore processes involving medium-sized herbivores	Small (ca 1000 ha) fragments of suitable habitat (bottomland savanna, succulent thicket, transitional shrubland)
Ecological diversification of plant lineages in relation to fine-scale edaphic gradients	Small (ca 1000 ha) areas of juxtaposed and contrasting edaphic habitats (e.g. shale:sandstone:quartzitic sandstone)
Ecological diversification of plant lineages in relation to mesoclimatic and larger-scale edaphic gradients	Medium (5000-10 000 ha) areas that span steep and long edaphic and climatic gradients (numerous appropriate gradients exist in the region)
Natural fire regimes	Large (50 000-100 000 ha) areas that are remote from human settlement or abut on non-fire-prone vegetation types (northern Kouga and Baviaanskloof Mountains)
Plant-herbivore processes involving large herbivores	Large (50 000-100 000 ha) areas of grassy fynbos-transitional shrubland-succulent thicket-bottomland savanna mosaic)
Predator-prey processes involving smaller omnivores and predators	Large (50 000-100 000 ha) areas
Diversification of plant lineages in relation to macroclimatic and fine-scale geographical gradients	Large (50 000-100 000 ha) areas that encompass maximal heterogeneity
Plant herbivore processes involving megaherbivores	Mega-sized (250 000-1 000 000 ha) areas including extensive succulent thicket and bottomland savanna habitat
Predator-prey processes involving top predators	Mega-sized (250 000-1 000 000 ha) areas
Migration and exchange between inland and coastal biotas	The Groot-Gamtoos riverine systems that breach the folded belt, thereby linking the Karoo basins with the Baviaanskloof basins and the Kouga valley
Faunal seasonal migration	Areas spanning lowland-upland gradients (Kouga and Baviaanskloof link to bottomland savanna; Baviaanskloof link to karroid broken veld)
Diversification of basal, upland animal lineages in lowland habitats	Areas spanning lowland-upland gradients (Kouga and Baviaanskloof link to bottomland savanna; Baviaanskloof link to karroid broken veld)
Diversification of plant lineages in relation to lowland-upland gradients	Areas spanning lowland-upland gradients (Kouga and Baviaanskloof link to bottomland savanna; Baviaanskloof link to karroid broken veld)
Diversification of plant lineages in relation to macroclimatic gradients	Large and steep climatic gradients along north-south and east-west axes in bottomland and upland regions
Hydrological regimes	Entire catchments including the entire catchment of the Baviaanskloof River
Resilience to climate change	Large and steep climatic gradients along north-south and east-west axes in bottomland and upland regions

6 CULTURAL ENVIRONMENT

6.1 Prehistory

The Eastern Cape has been inhabited by humans for many thousands of years. For example, at Klasies River on the Tsitsikamma coast to the south of the Baviaanskloof, there is archaeological evidence of human occupation dating back some 120 000 years. Artefacts from rock shelters in the Baviaanskloof indicate that prehistoric humans were living there from at least the Middle Stone Age (100 000 to 30 000 years ago). After a period of low population density between 60 000 and 20 000 years ago, stable Late Stone Age human populations became established in a series of phases. The hunter-gatherer San, who occupied the region until the Khoekhoen (= Khoikhoi) arrived about 2000 years ago, are considered to be the direct descendants of these early dwellers. The Khoekhoen, who were herders, migrated southwards from what is now Botswana with their sheep and cattle and later mixed with the San, to form a group known to archaeologists as the Khoisan. According to early European travellers, the Khoekhoen tended to live in the coastal areas, whereas the San were in the mountainous areas in the interior. The Khoekhoen were followed in turn, about 1700 years ago, by Bantu-speaking Iron Age agro-pastoralists who migrated southwards from central and eastern Africa with crops such as sorghum and millet, and domesticated sheep, goats and cattle.



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49. The shallow caves and overhangs formed by the sandstones of the Kouga and Baviaanskloof Mountains provided highly suitable substrates for San rock art, some of which dates back to 6 400 years ago. Although no comprehensive survey has ever been undertaken, there are considered to be hundreds of rock painting sites in the area. Members of the Eastern Province Section of the Mountain Club of South Africa have recorded 43 sites in the Kouga area and 28 in the Baviaanskloof. A number of other sites are known to reserve staff, archaeologists and local farmers (Photo: T.J. Coetzee).

50. In 1999 archaeologists from the Albany Museum in Grahamstown discovered the 2000 year old mummified remains of a San hunter-gatherer in a shelter in the Kouga Mountains. Significantly, a large flat slab of stone with San paintings was found at the grave (this being the first recorded case of a painted stone being used for marking a San grave). The remains, which were relatively well preserved, were covered by the leaves of a plant, gifbol (*Boophone disticha*). This plant is widely used for a range of medicinal purposes by indigenous people and it is possible that the leaves' chemical properties were employed as a form of preservative (Photo: J. Binneman).

Further westward movement would have led to contact with the San and Khoekhoen, and later the European colonists, in the western part of the present Eastern Cape. The region in which the Baviaanskloof is located can therefore rightly be considered as an important meeting place of these diverse cultures.

There is much evidence of the former presence of the San and Khoisan in the

Baviaanskloof area, this in the form of bone artefacts, floral and faunal remains and a wealth of rock art.

Other evidence of San occupation includes digging sticks and decorated wooden artefacts dating from 4.5 to 9.5 thousand years ago. Firesticks dating back some 6000 years have also been discovered. In particular, 9000 year old seed storage pits lined with vegetal matter (especially gifbol *Booophone disticha*) have been recorded. These are the oldest examples of such pits yet found in southern Africa and may indicate that food was a major constraint for the San population for a long period. There is a high probability that the Baviaanskloof area holds more sites with well-preserved plant material than any other region in southern Africa. Hence it is archaeologically important. Further evidence of the presence of the Khoekoen in the vicinity of the area is provided by the livestock remains found at Scott's Cave in the Gamtoos River Valley.

The BCA and environs is clearly a treasure-trove for Stone Age archaeology. Many sites still need to be discovered, while some have already been desecrated. What is urgently required is a professional and comprehensive survey of all archaeological sites to enable appropriate cultural research, conservation and interpretation.

6.3 History

The first European to enter the area was Georg Schmidt, a German missionary who arrived in April 1738. He achieved a measure of success in the Baviaanskloof where, by 1742, he had established a congregation of 26 souls, five of whom he christened. In 1743 Schmidt was forbidden by the Governor to conduct further missionary work and he returned to Germany in January 1744.

The first European farmer in the Baviaanskloof was a Mr Scheltema, who settled on the farm Vlakeplaas, a property which is still actively farmed today. The latter part of the 18th century and the early part of the 19th century witnessed the arrival of a number of farming families in the Langkloof, the Baviaanskloof, and the Cambria and Gamtoos River Valley areas. Most of these were of Dutch origin but some people of 1820 British Settler origin settled in the Gamtoos River valley. The main farming activity was pastoralism (mainly with goats) but tobacco, fruit, and wheat were also cultivated, mainly on the alluvial valley floors. After World War II, farmers in the Baviaanskloof starting focusing on the seed crop production, primarily because the degree of isolation of the valley allowed genetically pure and virus-free varieties to be cultivated.

There are a number of stone walls in a good state of repair in parts of the Baviaanskloof. Anecdotal evidence has it that they were constructed in the 19th century by a Bantu-speaking group ("Makatese"), from the Orange Free State. They were brought to the area specially for their stonewall-building skills. Some remained and became assimilated into the area.

The rugged terrain and the isolation of the valley from the marketplace were major constraints and a challenge for the early farmers in the Baviaanskloof. The situation was improved somewhat in the 1880s when Thomas Bain completed a road from the western entrance of the valley to the Grass Neck Pass, which lies beyond Kruis River, towards the east. The remaining stretch of road linking the valley with



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51. The presence of shelters for protecting domestic sheep provides evidence of the early occurrence of Khoekhoen herders in the area. Some shelters have been enclosed by stone walls, behind which are "smeared" dung floors and dressed stone internal walls. These walls were probably constructed by early European settlers who used the caves as stockades, or perhaps used them as temporary shelters while removing timber or constructing permanent structures in the vicinity (Photo: J. Binneman).

52. Although much of the land in the Baviaanskloof Conservation Area was claimed by Europeans around 200 years ago, permanent and more substantial dwellings were only constructed by farmers once they had received freehold title to their land. While some of these houses have disappeared, the remains of others are still standing. The best examples are those at Akkerdal (shown here), Rooikraal, Apieskloof and Guerna, all of which were erected some time between 1815 and the early 20th century (Photo: C. Urquhart).

53. People living in the Kouga-Baviaanskloof area have suffered periodic natural events such as floods, droughts and outbreaks of disease. A number of major floods have occurred in the valley (see Box 5). Only the flood of 1916 has been described in detail and the story is one of great destruction of farm buildings, churches, roads, fences, accompanied by loss of human life. Dozens of simple graves, including those of victims of the 1916 flood (shown here), bear witness to some of these disasters (Photo: F. Campbell).

Patensie was built as late as the 1930s. In the early years all produce had to be transported out of the valley by ox-wagon. This must have been a daunting undertaking, given the nature of the terrain and the long distances to cover. No wonder then, that journeys to town were few and far between, with some residents only undertaking the trip once a year. At one stage, donkeys were introduced for transport purposes, an action which led to some hybridisation between feral donkeys and the Cape

mountain zebra found there. In the Langkloof, the next valley lying to the south of the Baviaanskloof, the farmers were better serviced with transport through the completion of a narrow gauge railway to Port Elizabeth in 1918. This enabled these farmers to grow and profitably market some cash crops.

The South African War (1899-1902) had little impact on the Baviaanskloof. However, anti-British feelings ran high in the area and two British soldiers who were sent from the British Army Camp at Willowmore to patrol the valley were summarily ambushed and shot by the residents. Inhabitants of the Baviaanskloof gave a very friendly reception to a visiting commando of Cape Rebels, who were supporters of the two Boer Republics. In the Willowmore graveyard there is a tombstone of a boy who was killed by "colonial rebels and thieves who had deserted their commando". The anti-British feeling in the Baviaanskloof persisted because, during the 1914 Rebellion, when many South African citizens took up arms to unseat the post-Union government, posts were established at several strategic points in the kloof to "maintain law and order".

The San population living in the Baviaanskloof and environs came under pressure from the Khoekhoen, but the event that was to seal their fate was the arrival of the Europeans in the 18th century. As the latter settled and impacted the land, so the San became increasingly unable to maintain their traditional way of life. The new settlers hunted most of the indigenous animals to extinction, replacing game them with domestic stock, and the arable parts were put to cultivation. Many of the remaining San had little option but to move permanently onto the farms as servants and labourers, intermarry outside their culture and so merge with the wider population of the region. Others tried to maintain their way of life and in doing so often resorted to stealing livestock from the European settlers. This inevitably led to confrontation and several accounts record the violent demise of the San in the area. A farmer of the time, one Tjaart van der Walt, was the leader of a commando established to protect farmers and their stock, especially from the San and Khoekhoen. He carried out a number of sorties against them but was eventually ambushed and murdered by Khoekhoen under the leadership of Klaas Stuurman in the Cambria area in 1802. The last band of San in the Kouga Mountains was massacred by a commando of farmers in about 1880. During the same period, a band of San that had troubled the local farming community was hunted down in the Groot Winterhoek Mountains near Uitenhage, to the east of the Baviaanskloof. By the end of the 19th century the San had ceased to exist as an independent people in the area.

The population of the Baviaanskloof probably reached its zenith of about 2000 souls somewhere between the mid-19th and mid-20th centuries, whereafter it began to decline. This decline continues to the present day (see Section 3.3). Apart from the farmers whose properties were bought out in the 1960s for the construction of the Kouga Dam, no people in the area of the existing BCA were removed from their land by the State.

The full history of the European settlement, and its impact on the cultural environment of the area needs to be comprehensively researched and recorded. Since anecdotal evidence will provide much of the historical record, there is an urgency to initiate this study before the older generation pass on. In many cases it is already too late.

There are a number of threats that are impacting on, or have the potential to impact on, the status and effectiveness of the existing and an expanded BCA as a conservation area. These are discussed below.

7.1 Environmental issues

- Overstocking with domestic ungulates (mainly goats) is still common on some private properties in the area, especially in the western sector which is suitable for inclusion in an expanded BCA. This overstocking, resultant overgrazing and increased erosion, is leading to increased siltation of river systems. The net effect is a reduction in water quality in the rivers and the Kouga Dam.



54. Overgrazing by domestic goats, followed by accelerated soil erosion, presents a serious threat to biodiversity conservation and ecosystem integrity on land adjacent to the existing Baviaanskloof Conservation Area (Photo: G.I.H. Kerley).

- As farms in the upper Baviaanskloof area are becoming more marginal economically, there are increasing demands on the natural resources. For example, farmers are planning the construction of additional roads from the valley floor into the mountains to establish water troughs and thereby extend stock grazing. There are also plans to introduce more game into these areas; this will be accompanied by frequent burning of the mountain veld to encourage the growth of grass at the expense of the fynbos.
- Whilst the introduction of game (see above) is potentially an environmentally positive step, there is a real danger that some farmers may introduce species, especially ungulates, which are not indigenous to the area, or even to the Eastern Cape. This has already happened, with extra-limital species such as nyala (*Tragelaphus angasii*), impala (*Aepyceros melampus*), bontebok (*Damaliscus dorcas dorcas*), blesbok (*Damaliscus dorcas phillipsi*) and blue wildebeest (*Connochaetes taurinus*) having been introduced into the area. This may have negative ecological and economic consequences, and impact on the conservation and tourism value of the land in question.
- There has been large-scale transformation of the course of the Baviaanskloof River by farmers in the western sector. This has led to the drainage of wetland areas in the valley, with negative impacts on ecosystem functioning.
- Stands of invasive alien shrubs and trees, most notably black wattle, hakea, Port Jackson willow and rooikrans, are a threat to both biodiversity conservation and water production in the BCA. The stability of the river channels is also negatively impacted by invasive alien trees, especially black wattle which fall into and block river watercourses. Even though the present management authority has, in association with DWAF's Working for Water Programme, made good progress with the eradication of these aliens, many parts are still infested. Until these are eradicated, and all regrowth controlled, they will continue to pose a serious threat.
- DWAF is mooting the construction of a new dam in the Guerna area of the BCA. If built, the retained water would flood a substantial area within the BCA. This will result in a loss of terrestrial habitat, aesthetic transformation and the destruction of important archaeological sites.
- The BCA is becoming increasingly popular with tourists. However, with the reduced capacity of the management authority the regulations are being increasingly ignored and some visitors are driving and camping where they please. There is also pressure from the private sector to operate pleasure boats



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55. The introduction of extra-limital herbivore species, such as nyala (*Tragelaphus angasii*), onto private land in the near vicinity of the existing Baviaanskloof Conservation Area has potentially negative ecological and economic consequences for an expanded reserve (Photo: G.I.H. Kerley).

56. Invasive alien trees, such as the black wattle (*Acacia mearnsii*) from Australia, pose a threat to biodiversity conservation and water production in the reserve (Photo: D.J. Boshoff).

57. The rehabilitation of old agricultural lands, and former forestry management roads, is necessary to prevent soil erosion (Photo: J.D. Buckle).

on the Kouga Dam. All these actions have potentially negative aesthetic and environmental impacts.

- ❑ The lack of financial and human capacity to rehabilitate disused roads and old agricultural fields is resulting in increased erosion in places.
- ❑ The leopard population is severely threatened with persecution through the actions of stock farmers. It is essential that full protection be given to this species, a member of the Big Five, in an expanded BCA.
- ❑ With the increasing demand for honeybush (*Cyclopia* spp.) tea from the Cape Kingdom, some private landowners in the BCA environs are considering the harvesting of these plants for commercial purposes. Currently the demand outstrips the supply and this could lead to overexploitation of natural populations. Furthermore, the current initiative to establish honeybush tea orchards could

see the loss of large areas of pristine fynbos vegetation and valuable water catchment.

7.2 Institutional and policy issues

- There is a lack of progress in the Eastern Cape Province's Department of Economic Affairs, Environment & Tourism (DEAET) in selecting and implementing an institutional and organisational model that will, inter alia, allow effective management of the BCA. During the past four years there has been talk of placing the management of the province's nature reserves within a provincial statutory board, including the outsourcing of certain management functions. To date no final decision has been taken. The BCA has much potential to generate income, which in turn will reduce dependence for funding on the cash-strapped provincial government. However, it is vital that appropriate policies and strategies are in place prior to outsourcing, in order that the resource base (biodiversity) is protected.
- The provincial management authority does not have adequate scientific, management and financial capacity to manage the BCA effectively. Many experienced managers and scientists have left the service and are not being replaced. The present annual budget for the BCA allows for only the very basic activities to be maintained, and it can barely achieve this for a full 12 month period. The budget allocated to the provincial DEAET is in fact declining: of the 13 Departments in the Eastern Cape provincial government, only two were allocated fewer funds for the 2000/2001 financial year - one of the two is the DEAET, which underwent a decrease of 3% from the 1999/2000 financial year.
- There is no bio-regional plan, which would address the presence and development of the BCA in terms of biodiversity conservation and tourism as major land-use types. Private developments in the expanded BCA are currently taking place largely on an *ad hoc* basis.
- While there is some institutional and political support for the CDEA plan to consolidate and expand the western sector of the BCA, tangible progress has been frustratingly slow. What is urgently required is a senior official in CDEA to act as an in-house "champion" for the project.
- There is ongoing general deterioration of infrastructure (e.g. roads, buildings, communications) and cultural artefacts (e.g. historical houses, rock paintings) within the BCA and adjacent areas. Unless urgent steps are taken to provide appropriate institutional capacity and resources, this deterioration will continue and some artefacts will be lost forever, and others will become extremely expensive to rehabilitate.

7.3 Socio-economic issues

- A major threat to the vision for the consolidation and expansion of the western sector of the BCA is an initiative to purchase the farm Sewefontein, in the Baviaanskloof to the east of Studtis. This is part of a development plan to settle some 100 family units of landless people, who would practice agriculture with freehold title to the land. This plan is creating tension between local politicians and local community groups on the one hand, and the CDEA (and BCA staff in particular) on the other. The farmers appear to be vacillating in their support for the scheme. This issue requires urgent intervention from key stakeholders at the highest level. It is imperative that any final decision be based on the findings of a professional and comprehensive resource economics study.

Because of the high incidence (once every 10 years) of major flood events (see Box 5, Section 8.2), the Baviaanskloof is unsuitable for crop-based agriculture. Each major flood reduces the area of arable land and reshapes the valley floor. For example, it has been estimated that the 1916 and 1932 floods removed almost half of the arable land in the lower Kouga River catchment. In addition, serious loss of costly infrastructure, especially roads, causeways and telephone lines, usually accompanies each major flood.

- A number of privately sponsored developments have taken place, or are being mooted in areas bordering on the BCA. Whilst some (e.g. private nature



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reserves) have management goals which are consistent with the goals of the BCA, others (e.g. shops, campsites, tourist lodges) may not, and could thus present problems for future consolidation and expansion of the reserve.

- ❑ A paradoxical situation is developing in the upper Baviaanskloof. Notwithstanding the fact that there is a steady emigration of people from the valley, some farmers and community groups are pressing for the state to provide infrastructure (e.g. churches, schools, community halls) in the valley.
- ❑ There are a number of stakeholders and other interested and affected parties in conservation and tourism fields that are active in the Baviaanskloof area. Although most of them have broadly similar goals, there is a general lack of synergy between them and the approaches employed differ, often leading to tension. This could delay the attainment of the common goals.



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58. The successful implementation of the consolidation and expansion plan for the western sector of the Baviaanskloof Conservation Area, which potentially holds socio-economic benefits for thousands of people, is fully dependent on the purchase of all the private land in the Baviaanskloof. Recent studies clearly indicate that the conservation/tourism option holds the most sustainable economic development potential for this area (see Section 8.3) (Photo: C. Urquhart).

59. The issue of EIAs for private developments within the area adjacent to the existing reserve needs to be addressed. Failure to do so may impact negatively on the development options for an expanded reserve (Photo: D.J. Boshoff).



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60. A number of old farm buildings that exist in the Baviaanskloof Conservation Area can be restored to provide basic tourist facilities. Many of the structures, such as these at Guerna, are in an advanced state of disrepair and timeous action is required if they are to be saved (Photos: C. Van der Riet).

8.1 Biodiversity conservation

The BCA offers the opportunity of establishing a mega reserve that will effectively conserve biodiversity patterns and processes in the eastern mountains of the Cape Kingdom (see Section 3.1). Unlike the other two proposed mega reserves – in the Little Karoo and Cederberg – an expanded BCA will incorporate large areas of relatively productive habitat more typical of the thicket and grassland biomes, thereby having the potential to support viable populations of larger mammals. It will be the only conservation area within the Cape Kingdom which can support naturally occurring populations of the Big Five and other elements of large African game species.

The diversity of ecosystems in the proposed conservation area is extremely high, ranging from rainforest to desert. In this sense, the BCA is similar to the nearby Greater Addo National Park (GANP), although the diversity of Cape Kingdom ecosystems is much lower there. However, a unique feature of the BCA is that this outstanding ecosystem diversity is encapsulated within a wilderness context: visible human impacts are currently restricted to the middle reaches of the Baviaanskloof valley floor.

The BCA provides a unique opportunity to conserve an extremely high diversity of species (including many endemics), habitats and ecosystems in a reserve system that will ensure their persistence in the face of inevitable global change. Of particular significance is the opportunity to conserve most, if not all, of the ecological and evolutionary processes outlined in Table 3. These include:

- ❑ Specialist pollinator relationships.
- ❑ Plant-herbivore processes involving medium-sized, large and mega-herbivores.
- ❑ Diversification of plant lineages along fine- to large-scale edaphic gradients, meso- to macro-climatic gradients and lowland-upland gradients.
- ❑ Natural fire regimes.
- ❑ Predator-prey processes, from smaller omnivores to top predators.
- ❑ Migration and exchange between inland and coastal biotas along the Gamtoos-Groot River corridor.
- ❑ Faunal seasonal migration (e.g. Cape mountain zebra migration).
- ❑ Hydrological regimes.
- ❑ Resilience to climate change.



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61. Since 1843 the catchments in the Kouga-Baviaanskloof-Groot River area have been considered as an important source of water for crop irrigation by canal in the Gamtoos River Valley and, more recently, for supplying the Port Elizabeth/Uitenhage metropole. It is expected that the population of the metropole will grow at a rate of 2.4% per year, showing an increase of 104% from 1980 to 2010. Corresponding water demand is predicted to increase by 247%, giving an average annual growth rate of 4.2% (Photo: D.J. Boshoff).

62. The Kouga Dam (formerly the Paul Sauer Dam) was partially completed in 1964 and water started flowing from the dam to the Gamtoos Valley Irrigation Scheme in 1967. The scheme was completed in 1970, when it started to deliver water to the Port Elizabeth/Uitenhage metropole. The dam, which has a surface area of 555 ha and a storage capacity of 128 Mm³, has greatly reduced the impacts on humans of severe flooding in the Gamtoos River Valley (see Box 5) (Photo: D. Euston-Brown).

8.2 Water provision

The Kouga Dam is located upstream of the confluence of the Gamtoos and Groot rivers and is fed by two rivers, the Baviaanskloof River and the Kouga River. Almost the entire catchment of the Baviaanskloof River, and a substantial part of the catchment of the Kouga River, falls within the existing BCA (Map 8). It is estimated that the Baviaanskloof River supplies about 35% of the water for the Kouga Dam, which in turn supplies 100% of the water requirements of the Gamtoos irrigation area, and 30% of the requirements of the Port Elizabeth/Uitenhage metropole.

Box 5: Major flood events in the Baviaanskloof area.

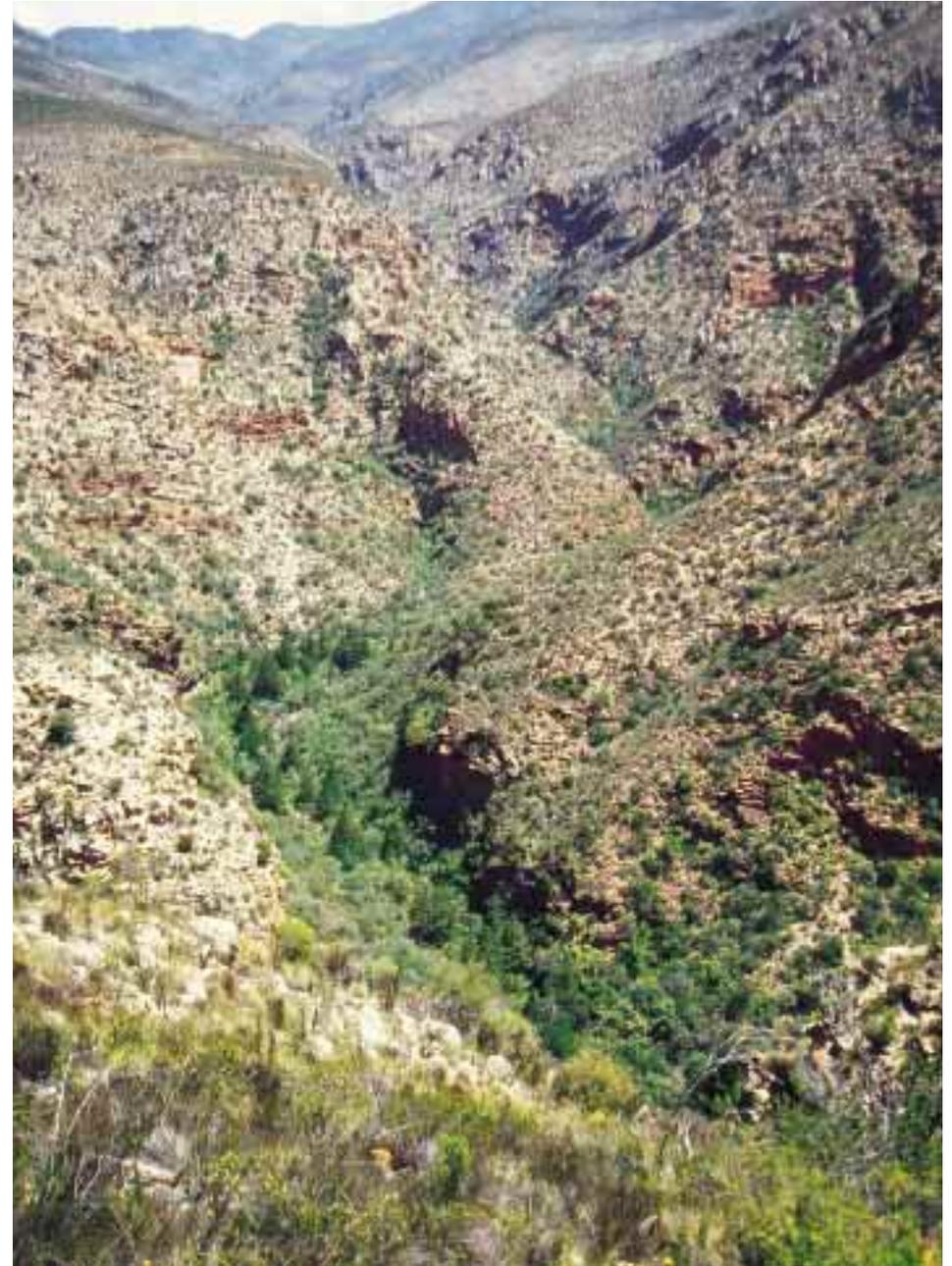
Given the nature of the terrain, rapid and severe floods are a feature of the catchments of the Baviaanskloof, Kouga and Groot rivers. For example, major flood events were recorded in 1847, 1867, 1905, 1916, 1932, 1944, 1961, 1963, 1971, 1977, 1979 (twice), 1981 (twice), 1983, 1993, 1996 and 2000. This means that, on average, a major flood occurs approximately once in every ten years. In the past, floods have caused much damage to tilled lands, roads, communications infrastructure and even loss of human life in the Baviaanskloof, thereby making the valley largely unsuitable for human settlement.

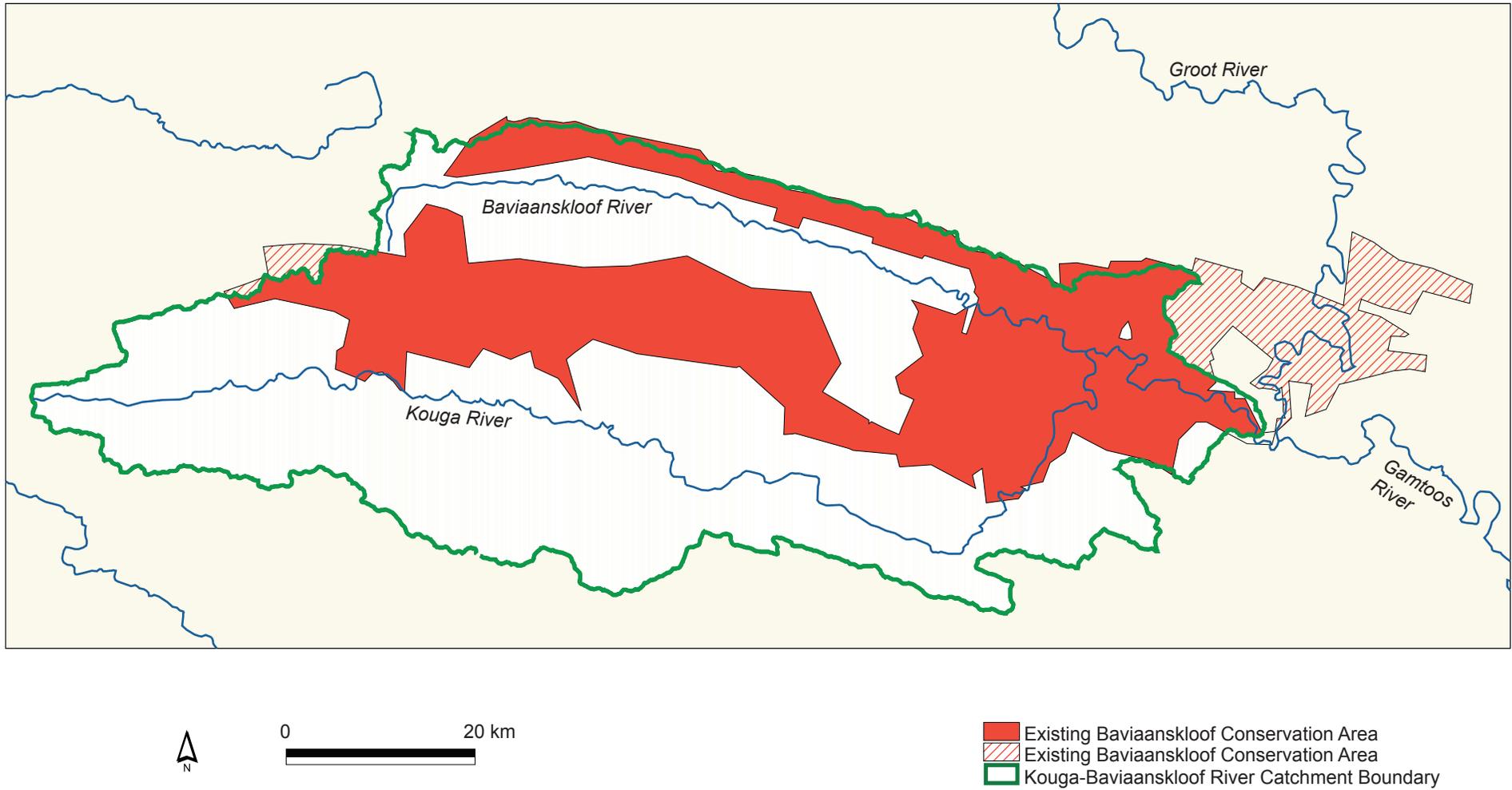
From these data, the present and future importance of the area as a sustainable source of good quality water for human, agricultural, industrial and environmental consumption downstream is obvious. There is now an opportunity to increase water security from the Kouga Dam to above the present level of 75% by including as much as possible of the catchments of the Baviaanskloof and Kouga rivers within an expanded BCA. If the southern boundary of the existing BCA is extended to the Kouga River, around 75% of the Kouga-Baviaanskloof catchment will be under conservation management (see Sections 4.3 and 5.4). This will permit the effective application of sound catchment management practices. In particular, that part of the catchment of the Baviaanskloof River that is currently under private ownership requires a change in land-use designation from "agricultural" to "conservation".

8.3 Tourism and socio-economic development

This section should be considered against the background given earlier (Section 3.3) on socio-economic issues related to the BCA and environs in a regional context; namely a declining agricultural sector, increasing migration from rural areas to towns, increasing rural and urban unemployment, increasing rural poverty, increasing reliance on welfare grants and pensions, reduction in services (health, welfare, education) and absence of economic development plans.

63. About 30% of the total catchment of the Baviaanskloof River, including the steady supply of water emanating from this tributary in the western Kouga Mountains, is managed almost exclusively for the benefit of 21 farmers. The results of bad farming practices in this section are in contrast with the sound catchment management practices in the Baviaanskloof Conservation Area. For example, in the former, overstocking has led to increased run-off, increased erosion rates and increased levels of siltation in the river and in the Kouga Dam. At present, the quality of the water provided by the Kouga Dam is far more desirable than that received by the Port Elizabeth/Uitenhage metropole from the Orange-Sundays scheme; the latter requires significantly greater expenditure on purification to achieve an acceptable quality (Photo: R.M. Cowling).





Map 8: The existing Baviaanskloof Conservation Area in relation to the boundaries of the Kouga and Baviaanskloof river catchments (Source: CAPE Project).

Tourism

The tourism development options for the existing and an expanded BCA are extremely varied, and include:

- ❑ Nature-based tourism, where tourists can experience spectacular landscapes and biodiversity (plant life and animal life). An important feature is that the animal life potentially includes the Big Five. These landscapes are also ideally suited for hiking, allowing tourists to enjoy a wilderness experience.
- ❑ Adventure tourism, which includes canoeing, mountaineering, horse-trails and 4x4 trails.
- ❑ Sports tourism in the form of fishing (for alien invasive species – bass, carp) and hunting. Hunting is specifically included in the 1997 CDEA proposal (see Section 4.3), and would be conducted within a specifically zoned area and based on the scientifically sound management of a number of naturally occurring game species.



A noteworthy feature of the Baviaanskloof region is that it is free of major tropical diseases, especially malaria. The increase in the spread of this disease across Africa is having a highly negative impact on tourism, and hence socio-economic development. The reserve will therefore make a major contribution to enable South Africa to position itself as the major malaria-free African tourism destination. The area is also blessed with a pleasant climate that makes year-round tourism eminently possible. Tourist safety, a major concern in the development of this industry, is currently very high in the reserve and surrounding areas.

In terms of tourist access, the BCA is extremely well positioned. Relatively close to the Western Cape tourism node, it provides the closest opportunity for an African large-game experience and habitat for the Big Five, important for game-viewing tourists. The reserve is also adjacent to the world-famous Garden Route, and could easily be appended to the Garden Route tourist experience. Furthermore, its eastern boundary is only 75 km on a surfaced road from Port Elizabeth, the location of a well-developed international airport and an important port of call for cruise liners.

Another important feature about the access to the BCA is that a number of "gateways" can be developed to facilitate tourism access. These include, for example:

- a "Western Gateway" through Willowmore, via Nuwekloof Pass,
 - a "Northern Gateway" through Steytlerville, via Groot River Gorge or direct to the northern Karoo areas,
 - an "Eastern Gateway" through Hankey and Patensie via the picturesque and intensively cultivated Gamtoos River Valley, and
 - a "Southern Gateway" via Joubertina in the Langkloof.
- These various access points will provide excellent development options for tourism entrepreneurs from the private sector, in areas that currently have virtually no development options.

The proposed development of an expanded BCA should be seen as complementary to the development of the Greater Addo National Park. These mega parks together have the potential to establish the Eastern Cape as a premier big game destination in Africa, and offer a highly diverse range of tourism experiences. With the tourism industry positioning itself for a major boost in visitor numbers, it is critical that these opportunities be exploited.

The various gateways and spectacular landscapes provide a critically important opportunity to develop the BCA using well-planned zonation. Most of the high-impact tourism developments should be located on the periphery of the reserve. This has the major advantage of reducing tourism impact within the protected area, thereby maintaining the ecological and wilderness integrity of the landscape. At the same time this would provide development opportunities to communities on the border of the reserve. In recognition of the importance of its wilderness aspect and the need for sustainable development, tourism developments within the BCA should be of a low-density, low-impact nature. All tourism developments should therefore adhere strictly to the requirements of the EIA legislation.

64. Tourist accommodation at Geelhoutbos in the western section of the Baviaanskloof Conservation Area. Currently, six tourist accommodation sites (three campsites, three hutted sites) are operated in the reserve (Photo: R.M. Cowling).

Socio-economic development

A consolidation and expansion of the BCA, and the appropriate development of its tourism potential, will undoubtedly provide a number of socio-economic benefits at the local, regional and national levels:

- ❑ Permanent jobs will be created within the BCA, particularly in the conservation management and the hospitality sectors.
- ❑ Casual jobs will be created within the BCA, e.g. for labour intensive management projects, such as game capture, alien vegetation eradication and fencing.
- ❑ Jobs will be created in the service and peripheral industries, e.g. suppliers of services and materials, suppliers of skills such as builders, plumbers, caterers, tourist guides, etc. This will be particularly important during the development phase of the BCA, when local industries will be called upon to provide the materials for, and the erection or construction of, hundreds of kilometres of fencing, roads, tourist rest camps and other infrastructure.
- ❑ Opportunities for public-private sector partnerships, e.g. lodge construction and operation.
- ❑ Opportunities for outlets for local produce.
- ❑ Training opportunities for local people.

Owing to the sustainable nature of the proposed land-use, the potential for the long-term viability of the jobs created will be good, or at least better than that in the agricultural industry. Tourism can be one of the most effective means of spreading

wealth from affluent people to rural communities and the expanded BCA will be very well placed to fulfil this role.

Socio-economic information from studies conducted by the Terrestrial Ecology Research Unit in and around the nearby Addo Elephant National Park in the mid-1990s can serve as a realistic model for the BCA. The financial analysis clearly showed that conservation/tourism, besides being ecologically sustainable, also generated more income than a comparable pastoral operation, and was generally profitable.

Visitors spent a conservatively estimated R360 million travelling (flights, car hire, fuel, hotels, etc.) to the Park in 1996. This figure does not include what the visitors spent in the reserve for accommodation, meals, supplies, game-drives, tips, etc. The total GGP of the districts within which the proposed Greater Addo National Park will fall (Alexandria, Kirkwood, Somerset East and Jansenville) is lower (R297 million in 1992, no data available for 1996) than the amount spent by visitors travelling to the existing Park in 1996, although the tourist figure is distributed over a far wider area. Thus, conservation/tourism has the clear potential to be a major economic role-player in the Eastern Cape.

In terms of employment opportunities, conservation/tourism also has undoubted potential; the existing Park employs twice as many people at four times the income of a comparable pastoralism operation. Furthermore, on-site employment figures seriously underestimate the employment opportunities provided by conservation/tourism as a form of land-use, as tour operators, service providers and other ripple effects also generate jobs. It has been estimated that 10 foreign tourists create one local job and thus the 100 000 plus annual visitors to Addo, half of which



65. The development of the tourism potential of the Baviaanskloof Conservation Area will stimulate the growth of the economies of towns on the periphery of the reserve. For example, there will be a significant increase in the demand for services provided by petrol stations, bed and breakfast establishments, restaurants and curio shops (Photos: D.J. Boshoff).

are foreigners, potentially generate about 5 000 direct and indirect employment opportunities.

Conservation/tourism holds the greatest promise as an economically viable land-use option in the BCA (see Box 6), bringing with it significant potential for wealth generation and job creation.

Box 6: How does conservation and associated tourism fare as an economically viable land-use option in the Baviaanskloof Conservation Area ?

Using a multi-criteria analysis (MCA) approach, based on an ordinal scale, a recent (1999) study by the University of Cape Town provided a preliminary assessment of the socio-economic impacts of four land-use scenarios in the western sector of the existing BCA. The following eight criteria were used: employment; remuneration; disruption and choice; services; gross income; conservation; effects on water and potential to secure funding. The four scenarios are as follows.

Scenario 1: Maintain the *status quo*

The current land-use activities, namely agriculture and conservation (existing BCA, under provincial management) would persist. Few or no additional direct or indirect employment opportunities would be generated in the valley or in the surrounding towns.

Scenario 2: Expand and consolidate the BCA

This involves the consolidation of the western sector of the BCA through the purchase of approximately 56 000 ha of private land in the Baviaanskloof. It also involves the purchase of about 20 000 ha of land on the northern boundary of the reserve to form a commercial hunting zone. A significant number of additional direct and indirect employment opportunities would be generated in the valley and in the surrounding towns.

Scenario 3: Establish a game farm conservancy

This sees the cessation of agricultural practices on private land within the western sector of the BCA and the formation of a Baviaanskloof Private Nature Reserve Association which would develop and manage the area exclusively for game-farming, conservation and tourism. Few additional direct or indirect employment activities would be generated in the valley and in the surrounding towns.

Scenario 4: Intensify operations within the existing BCA

Current tourism activities within the existing BCA would be intensified, with the agricultural component maintaining its *status quo*. Few additional direct or indirect employment activities would be generated in the valley and in the surrounding towns.

In the MCA assessment, Scenario 2 was ranked "1" in seven of the eight cases. This study clearly indicates the superior socio-economic development potential of the conservation/tourism land-use option.

An expanded BCA will therefore have the potential to significantly increase the contribution of these activities to the local, regional and national economy. However, its actual contribution will depend on many factors and there is therefore a need for market research and development planning to be undertaken. Suffice to say that it offers a major socio-economic development opportunity in a human landscape that has no other options. It is important, though, that delivery from the BCA must be swift, in order to counter the effects of reducing opportunities associated with agriculture practices.

There are a number of historical houses in the existing reserve that could be restored and used to provide a range of tourist facilities. If restoration is delayed any longer these buildings will deteriorate beyond repair.

8.4 Linkages with other conservation areas

The boundaries of an expanded BCA, as identified in this report (Map 5), should not be regarded as final. It is of great importance that the reserve be linked as far as is feasible to other conservation areas in and on the periphery of the eastern end of the Cape Kingdom (Map 9). Such linkages are crucial for the maintenance of mega corridor reserves. These will ensure the conservation of large-scale evolutionary processes such as geographic speciation in relation to climate change, as well as impart greater resilience to this change.

The CAPE Project explicitly recognises the need for mega corridor reserves that will:

- ❑ maintain migratory routes and evolutionary fronts between major climatic zones;
- ❑ facilitate shifts in species' distribution along macro-scale gradients in response to climate change.

In this respect, and in accordance with the recommendations arising from the CAPE Project, we make the following recommendations for linking the BCA to other reserves (Map 9):

- Southwards extension to the provincial reserve in the Tsitsikamma Mountains and the forest and coastal ecosystems of the Tsitsikamma National Park.
- Westwards expansion via the provincial reserve in the Antoniesberg to the provincial nature reserve in the Klein Swartberg Mountains.
- Eastwards expansion to the provincial Groendal Wilderness Area. There is also good potential to link the BCA with the proposed Greater Addo National Park by incorporating the succulent-rich Springbokvlakte and upper Groot River Valley, as well as the currently degraded and unproductive xeric succulent thicket to the east.

9

RECOMMENDATIONS

- ❑ The Baviaanskloof Conservation Area (BCA) must be managed by an authority that has sufficient financial and human capacity to fulfil this function effectively. The management agency must operate according to a model that allows it to retain income, take out loans, appoint suitable staff, etc.
- ❑ Owing to the severe threats, and the high conservation value of its ecosystems, the first priority for conservation action should be the consolidation of the western sector of the BCA, i.e. the purchase of all private land in the upper Baviaanskloof.
- ❑ The second priority should be the expansion northwards into the Nama-karoo and southwards to the Kouga River.
- ❑ Every effort must be made to ensure that expansion of the BCA is done in a socially sustainable way and the reserve must provide a series of immediate benefits. In this regard, explicit targets for job creation and other socio-economic opportunities must be set.
- ❑ As a matter of urgency, a comprehensive and professional socio-economic study needs to be conducted on the various land-use options, prior to any land settlement schemes being implemented on private land adjoining the existing BCA.
- ❑ The BCA consolidation and expansion project requires an impartial "champion" – to promote, facilitate and co-ordinate research, planning and development actions, and to develop a synergy within the entire spectrum of stakeholders.
- ❑ Most of the reserve must be zoned and managed as a wilderness area (to protect biological patterns and ecological processes). Tourism activities and development nodes must be restricted so as not to compromise this status.
- ❑ The BCA, in its existing or expanded form, must be awarded national protected area status and conform to Category Ia, Ib, II and III IUCN Protected Area Categories. Its eligibility for World Heritage Site status must be assessed.
- ❑ Research must be undertaken to fill gaps in the biological, ecological and cultural history inventories. This information is important for regional, national and international conservation planning in the future.
- ❑ International funding must be secured to cover the incremental costs of implementing the expanded reserve.
- ❑ The BCA must not be developed in isolation. For example, the outcomes of the CAPE Project in relation to the BCA need to be developed further in the context of a bio-regional development plan.

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Acronyms used in the text

AENP	Addo Elephant National Park
BCA	Baviaanskloof Conservation Area
BFR	Baviaanskloof Forest Reserve
CAPE	Cape Action Plan for the Environment
CDEA	Chief Directorate: Environmental Affairs (Eastern Cape)
DEAET	Department of Economic Affairs, Environment & Tourism (Eastern Cape)
DNC	Directorate Nature Conservation (Eastern Cape)
DWAF	Department of Water Affairs and Forestry (national government)
EIA	Environmental Impact Assessment
GANP	Greater Addo National Park
GGP	Gross Geographic Product
HDI	Human Development Index
IUCN	International Union for the Conservation of Nature
NGO	Non Governmental Organisation
WDC	Western District Council
WWF-SA	World Wide Fund for Nature – South Africa

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