
GOVERNMENT NOTICES • GOEWERMENTSKENNISGEWINGS

DEPARTMENT OF ENVIRONMENTAL AFFAIRS**NO. 1567****06 DECEMBER 2019****NATIONAL ENVIRONMENTAL MANAGEMENT: BIODIVERSITY ACT, 2004 (ACT NO. 10 OF 2004)****BIODIVERSITY MANAGEMENT PLAN FOR THE BONTBOK (DAMALISCUS PYGARGUS)**

I, Barbara Dallas Creecy, Minister of Environment, Forestry and Fisheries, hereby, under section 43(1)(b), read with section 43(3) of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004), publish a Biodiversity Management Plan for the Bontebok (*Damaliscus pygargus pygargus*) in the Schedule hereto.



BARBARA DALLAS CREECY
MINISTER OF ENVIRONMENT, FORESTRY AND FISHERIES

SCHEDULE

**BIODIVERSITY MANAGEMENT PLAN FOR THE BONTEBOK
Damaliscus pygargus pygargus
IN
SOUTH AFRICA**



Jointly developed by SANParks and CapeNature

Carly Cowell¹ and Coral Birss²

¹Cape Research Centre, South African National Parks

²Scientific Services, CapeNature

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FOREWORD - PROF CHRISTO FABRICIUS

Soon after the first Europeans arrived in South Africa they encountered two spectacularly coloured antelope types that closely resembled one another. They called them bontebok and Blesbok but, as one does with siblings that look alike, regularly mistook one for the other; the first of many mix-ups in the bontebok's recent history. This on-going confusion was an important contributor to the near-extinction of bontebok with its narrower habitat requirements and smaller numbers. The unfortunate animal was, after being almost hunted to extinction, practically hybridized to extinction through human-influenced interbreeding. But it was also humans, the cause of the problem, who brought bontebok back from the brink of extinction when a few farmers in the Bredasdorp area started to actively conserve them. These bold actions, aimed at breeding the species, first gave rise to the establishment of bontebok National Park and later led to the proclamation of De Hoop Nature Reserve. The fortunate (albeit unintended) consequence of this was the preservation of equally threatened ecosystems: Fynbos and Renosterveld. It's a fascinating history and strong cultural and ecological association with the Fynbos biome make the bontebok an ideal flagship for ecosystem conservation. A strategy to conserve it must therefore have more to it than mere genetic conservation or protected area expansion: bontebok must now become part of the Fynbos Biome's and South Africa's legacy and identity. Its conservation strategy therefore quite aptly includes a strong outreach and awareness-raising component which will definitely cultivate public admiration for and attachment to this very special species - and its habitat. It should be easy to gain public support for such a likeable animal. This first Biodiversity Management Plan is an important step towards establishing bontebok as the flagship for collaborative adaptive ecosystem conservation in the Fynbos Biome. A host of Provincial and National government departments, parastatals, NGOs and academic institutions have jointly taken responsibility for the plan's implementation, with citizen's participation and co-management at the heart of it. The management plan has four solid legs: 1) safe-guarding genetic integrity; 2) conserving and restoring natural habitats; 3) communicating and raising awareness; and 4) managing adaptively, underpinned by research and monitoring. The many proposed actions may present capacity challenges. But this could also build resilience: not all strategies have to be implemented at once. The difficult part will be to safe-guard bontebok's genetic integrity, particularly in the face of hunters' and game farmers' demand for animals that are purpose-bred for appearance, especially when mounted on trophy room walls. But with the flagship appeal of the species, the organizational synergy that now exists, the binding legislation, and adaptive management, the future for bontebok looks much brighter today than before. Those visionary Bredasdorp farmers and forward-looking officials who started it all would be smiling from ear to ear if they were here.

EXECUTIVE SUMMARY

Bontebok (*Damaliscus pygargus pygargus*) is endemic to the East Coast Renosterveld bioregion within the Cape Floristic Region (CFR) of the Western Cape. Evidence from fossil records indicate that past climatic and habitat change promoted the splitting of *D. pygargus* into the two separately classified subspecies known today; blesbok (*Damaliscus pygargus phillipsi*) and bontebok (*Damaliscus pygargus pygargus*). Each subspecies exhibits different behavioural and morphological traits including body markings and hide colours. Historically, the natural ranges of the two subspecies did not overlap, with blesbok occurring widely on the grasslands of Gauteng, Eastern Cape, Mpumalanga and Free State and bontebok restricted to the coastal plains in the southern CFR. Here the numbers of bontebok declined to near extinction due to hunting and human settlement, in the 1800s, to a known population of 20 animals in the Bredasdorp area. As a result a national park was proclaimed to protect the remaining bontebok and their numbers increased. Worldwide, habitat loss and the loss of genetic integrity by anthropogenic hybridisation currently threaten many species. Wildlife species are extensively translocated outside of their historic distribution ranges onto private land as a part of wildlife management and commercial breeding practices in South Africa. This has at times led to multiple species on the same property outside their natural ranges. Thus, the two subspecies (bontebok and blesbok) have come into contact and hybridized, a case which would not have happened naturally as they historically had largely non-overlapping ranges with different ecosystems.

Bontebok now occur in a number of small, isolated populations across the country and are threatened by low genetic diversity, population fragmentation, habitat fragmentation and hybridisation with blesbok and blesbok/bontebok hybrids. In order to mitigate the historic and current threats to bontebok and conserve this iconic species an integrated management strategy, applied through collaborative partnerships between stakeholders, is urgently required. This would encourage public support, ensure genetic diversity within the meta-population and sustainable utilisation of the species by the private sector.

The bontebok population within the Natural Distribution Range (NDR) and Extended Distribution Range (EDR) in the Western Cape comprises approximately 1650 individuals. An approximately further 7500 individuals survive on properties outside the NDR of the species throughout South Africa. Bontebok are tolerant of human activities and adapt to changes in the landscape and readily utilise transformed landscapes with old fields of short grass areas. The bontebok is listed as Vulnerable (D1, B2a) on the International Union for Conservation of Nature (IUCN) Red List of Threatened Species, as a Protected Species under the Threatened or Protected Species (TOPS) regulations in terms of Section 56(1) d of the National Environmental Management: Biodiversity Act (Act 10 of 2004), and on Appendix II under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). The non-detrimental finding (NDF) for bontebok issued by the Scientific Authority recommended a BMP-S to improve the management and monitoring of the subspecies.

In 2011, an inter-agency collaboration between South African National Parks, CapeNature and the National Department of Environmental Affairs was initiated to develop a bontebok BMP-S to ensure the long-term survival of the species in nature. Engagements with a variety of stakeholders took place and identified threats and challenges to the persistence of bontebok. These include human-mediated hybridisation and loss of genetic diversity, habitat loss, disease and parasite problems and the risk of unintended hybridisation as well as the lack of a meta-population management plan. The selection of the bontebok for a BMP-S is based on the recommendations from the NDF, its threat status, the need for a meta-population strategy and inter-agency collaboration on shared objectives for the conservation of the species, standardised monitoring, cooperative research, and increased participation by landowners.

Both internal and external stakeholder consultations developed the following **desired state** for the bontebok: *“The conservation of a secured and well managed* bontebok meta-population.”*

** Well managed: an increase in pure Bontebok numbers especially in their indigenous range, sustainable use of habitat and species, securing genetic integrity, researched and regulated to inform decision making and planning.*

This desired state is aimed at creating a long term vision for successful conservation of this species and this is to be achieved by a set of associated **objectives**:

- To conserve the genetic integrity and diversity of bontebok;
- To prevent further habitat loss and habitat degradation, and establish and maintain historic habitat connectivity;
- To establish and maintain effective communication and awareness between and among stakeholders; and
- To investigate and conduct research aimed at supporting adaptive management and the implementation of actions to promote and ensure bontebok conservation.

The implementation of the bontebok BMP-S will have the following **benefits**:

1. Ensuring the bontebok population inside and outside (nationally) the NDR increases and is resilient to threats faced;
2. Ensuring that harvesting and off-takes of bontebok are sustainable;
3. Scientific sound meta-population management is implemented and through this the full extent of genetic diversity is represented throughout the population;
4. To facilitate the establishment and maintenance of a National Database to advise on the status of populations;
5. Identify priority conservation land for bontebok conservation within the NDR;
6. Promote collaboration and cooperation between government agencies as well as between government and the private sector;
7. Coordinated management actions; and
8. Identify accountable parties and clearly define roles and responsibilities.

The anticipated **outcomes** of the BMP-S are as follows:

1. The management of the bontebok population inside and outside (nationally) the NDR to ensure the long term survival of this species;
2. A co-ordinated national approach to bontebok conservation both in- and outside of the NDR in terms of management, monitoring and research;
3. The halt of the loss of habitat and ultimately ensuring a steady increase in conserved habitat and rehabilitation of degraded areas for re-introduction of bontebok especially within, but also outside the NDR;
4. Highlight research and communication priorities and identify appropriate parties to implement actions;
5. A National Database of population distribution and national testing and profiling protocols for bontebok;
6. The identification and immediate elimination of hybrids of this species to maintain the economic and conservation value of bontebok; and
7. Promotion of bontebok as an iconic flagship conservation species for Renosterveld vegetation, the CFR and the World Heritage Sites found there.

The Fynbos Biome comprises more than 120 different vegetation types, and there are four different types of Renosterveld in the NDR of the bontebok: Western-, Central- and Eastern-Rûens Shale Renosterveld and Rûens Silcrete Renosterveld. Today, this Renosterveld is highly fragmented with fewer than 50 fragments over 100 ha remaining. Before human settlement in the region, this vegetation type supported large numbers of big game, including black rhino, eland, the now extinct bluebuck and quagga, and bontebok. Sadly, the extirpation

of the large herbivores and severe transformation of the landscape has allowed extensive areas to become degraded. The bontebok is recognised as an iconic flagship species for the protection and conservation of Renosterveld. The Biodiversity Management Plan for the bontebok provides the opportunity for the conservation of both the bontebok antelope and the critically endangered renosterveld vegetation type on which they naturally occur. It serves as a reference to the management and development of the identified actions to enable stakeholders to contribute to the desired outcome of ensuring the long term survival of the subspecies in nature and thereby ensuring the sustainable use of the bontebok by private land owners participating in the meta-population strategy.

The bontebok BMP-S focusses on implementing a meta-population strategy and associated conservation actions aimed at ensuring that bontebok populations are and stay genetically diverse, and overall meta-population fitness and resilience within and outside the NDR is enhanced and maintained in the long-term.

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- SANParks Scientific Services and Veterinary Wildlife Group (list attached as Appendix 2).
- CapeNature Bontebok BMP-S Technical Working Group (list attached as Appendix 3).

ABBREVIATIONS AND ACRONYMS

BCTUP	Western Cape Bontebok Conservation, Translocation and Utilisation Policy – Operational Guideline
BMP-S	Biodiversity Management Plan for Species
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CBD	Convention on Biological Diversity
CFR	Cape Floristic Region
CN	CapeNature
DAFF	Department of Agriculture, Forestry and Fisheries
DEA	Department of Environmental Affairs
DNA	Deoxyribonucleic acid, the molecule that carries most of the genetic instructions used in the development, functioning and reproduction of all known living organisms
EC DEDEAT	Eastern Cape Department of Economic Development, Environmental Affairs and Tourism
ECPTA	Eastern Cape Parks and Tourism Agency
ENDR	Extended Natural Distribution Range
FS DESTEA	Free State Department of Economic, Small Business Development, Tourism and Environmental Affairs
IUCN	International Union for Conservation of Nature
MOU	Memorandum of Understanding
NC DENC	Northern Cape Department of Environment and Nature Conservation
NDF	Non-detriment Finding
NDR	Natural Distribution Range
NEM: BA	National Environmental Management: Biodiversity Act 10 of 2004
NEM: PAA	National Environmental Management: Protected Areas Act 57 of 2003
NEMA	National Environmental Management Act 107 of 1998
NR	Nature Reserve
NRF	National Research Foundation
PHASA	Professional Hunters Association of South Africa
SAHGCA	South African Hunters and Game Conservation Association
SANBI	South Africa National Biodiversity Institute
SANBI: NZG	South Africa National Biodiversity Institute: National Zoological Garden
SANParks	South African National Parks
SARDB	Red Data Book of the Mammals of South Africa
SAHGCA	South African Hunters & Game Conservation Association
SCI	Safari Club International
SSC	Species Survival Commission
TMF	Table Mountain Fund
ToPS	Threatened or Protected Species Regulations
ToR	Terms of Reference
WCNCB	Western Cape Nature Conservation Board
WC GDDB	Western Cape Game Distribution Database
WC DEA & DP	Western Cape Department of Environmental Affairs and Development Planning
WCPAES	Western Cape Protected Area Expansion Strategy
WG1	Working Group on Biodiversity and Conservation

WRSA	Wildlife Ranching South Africa
WWF	World Wildlife Fund
WWF-SA	World Wide Fund for Nature – South Africa

GLOSSARY OF DEFINITIONS, SCIENTIFIC AND TECHNICAL TERMS

In this BMP-S, unless the context indicates otherwise, a word or expression defined in the National Environmental Management: Biodiversity Act (NEM: BA, 10 of 2004) or Protected Areas Act (NEM: PAA, 57 of 2003) has the same meaning.

Genetic diversity	Genetic diversity is the total number of genetic characteristics in the genetic makeup of a species. It is distinguished from genetic variability, which describes the tendency of genetic characteristics to vary. Genetic diversity is required for populations to adapt to environmental change. It is measured using an array of molecular and quantitative methods. Large populations of naturally outbreeding species usually have extensive genetic diversity, but it is usually reduced in populations and species of conservation concern (Frankham <i>et al.</i> 2002).
Rehabilitation	The mechanism of aiding an ecosystem to reach a functional state.
Restoration	The action of returning an ecosystem to its original state or condition, or a species to its original place.
Monitoring	The collection and analysis of repeated observations or measurements to evaluate change in status, distribution or integrity in order to track the impacts of directed management implemented to achieve a stated management objective.

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1) INTRODUCTION

Bontebok (*Damaliscus pygargus pygargus*) is a subspecies of antelope endemic to the East Coast Renosterveld bioregion within the Cape Floristic Region (CFR) of the Western Cape. As an iconic flagship species for conservation success in South Africa, it was on the verge of extinction in the early 1800s. A few animals were saved by farmers in the Bredasdorp area and a national park was proclaimed to conserve this species. Currently, the population estimate within the natural distribution range (NDR) is approximately 515 mature individuals. A loss of the natural habitat within the NDR has prompted conservation authorities to extend the natural range to nearby suitable areas within the same ecoregion. Here, subpopulations have increased to approximately 805 mature individuals. Bontebok occur on private properties in the Western, Eastern and Northern Cape Provinces as well as in the Free State and North West Province. Total population estimates of bontebok subpopulations on private land are estimated at 8100 on private land, with an estimated 1038 bontebok occurring on protected areas in the Eastern and Western Cape. Of these, less than 700 occur in the NDR. Only an estimated 220 bontebok occur on private land within the NDR, with an additional 667 potentially constituting benign introductions outside the NDR. Hybrids resulting from hybridisation with blesbok (*Damaliscus pygargus phillipsi*) are largely prevalent outside the NDR and EDR in a large proportion of subpopulations on private land.

Bontebok numbers outside the natural distribution range (NDR) are increasing, however, the core population within the NDR has not increased since 2004. Protected area expansion possibilities are limited within the NDR, thereby limiting core population growth. The major threats to bontebok are the uncertainty around the number of hybrids within the existing meta-population, lack of habitat availability within its natural range (thus limiting population expansion), and the lack of a meta-population plan to sustain genetic diversity. Given that the estimated population sizes are still very low, a management plan is required to guide the genetic testing, data capturing, management and protection of this species for future South African generations.

1.1 Bontebok

Bontebok is a medium-sized antelope with a multi-coloured coat, is endemic to the Western Cape and was historically confined to the grassy southern coastal plains and Renosterveld of the CFR. Population numbers of bontebok reached a critical low in the 1930s when only approximately 17 animals remained. The Bontebok National Park was proclaimed in the Bredasdorp district in 1931 to protect the species (Barnard and van der Walt 1961). Although bontebok numbers increased to around 100, population growth thereafter halted as the habitat of the park was found to be unsuitable for this species. In the 1940s, five animals were sent to Grahamstown to establish a population elsewhere in the then Cape Province as a back-up against the loss of the populations in the Bredasdorp area (Van Rensburg 1975).

In 1961, the Bontebok National Park moved to the present site in the Swellendam area and the bontebok were transferred from the original park as well as 16 animals from Grahamstown (Thornkloof Farm). Additional animals from Thornkloof were also sent to De Hoop Nature Reserve and Cape Point Nature Reserve (now Table Mountain National Park). In the 'new' Bontebok National Park, numbers increased to a maximum of over 400 in the 1980s with the current population being approximately 260, with a further 197 in other National Parks. Bontebok National Park can no longer expand in size to accommodate a larger bontebok population.

1.2 The need for a BMP-S for bontebok

Bontebok have a very limited NDR and is endemic to the Western Cape. There are about 515 mature individuals left in the NDR. The founding population numbers were very low and have been through a severe genetic bottleneck, hence their genetic diversity is threatened through loss of genetically fit animals. With the historic establishment of bontebok population outside the NDR in the EDR and Eastern Cape, Northern Cape and Free State, and elsewhere, and the rather limited opportunity for bontebok population expansion inside the NDR, there is a need for coordinated and adaptive management of the bontebok meta-population to ensure the long term survival of and mitigate negative impacts on the subspecies.

Of the vegetation types that bontebok antelope originally occurred in, more than 50% are Critically Endangered with a further approximately 20% either Endangered or Vulnerable, resulting in 70% of their habitat being under threat. Also, very little of these vegetation types where they occur is left in the agriculture-dominated landscape, and renosterveld habitats in general within the NDR have been reduced to <10% of their original extent. Furthermore, there is a significant risk of hybridisation with the closely-related blesbok antelope, which if not actively prevented, could result in the extinction of this subspecies as a taxon.

Bontebok are an iconic flagship species for conservation of the CFR, the Fynbos Biome, threatened landscapes and threatened plant populations. Bontebok are listed as Vulnerable by the IUCN Species Survival Commission (SSC), in their IUCN Red List of Threatened Species. They are also listed as a Protected Species under the Threatened or Protected Species (TOPS) regulations in terms of Section 56 (1)d of the National Environmental Management: Biodiversity Act (Act 10 of 2004), and listed in Appendix II under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). The non-detriment finding for bontebok issued by the Scientific Authority recommended a BMP-S to improve the management and monitoring of the subspecies.

Bontebok play an ecological role in the creation of landscape heterogeneity through grazing (Kraaij and Novellie 2010; Novellie 1987) via the creation of grazing lawns (Cowling et al. 1986; Krug et al. 2004) and the modification of and use of fire regimes (Kraaij and Novellie 2010; Krug et al. 2004; Luyt 2005; Novellie 1987). They are also hosts for parasites (Boomker and Horak 1992; Boomker et al. 1983; Boomker 1990; Horak and Boomker 1998; Horak et al. 1982; Horak et al. 1997) and contribute to our ecological knowledge through their genetic uniqueness, as one can establish the passage in time since divergence from a common ancestor (Essop et al. 1991; Fabricius et al. 1989; Fabricius 1991; Kumamoto et al. 1996; Van der Walt et al. 2001).

1.3 Vision and Desired state

The purpose of a BMP-S is to ensure the long term survival in nature of species which are listed under the TOPS Regulations (published in terms of the National Environmental: Biodiversity Act) or where a BMP is deemed necessary for a particular species. The scope of this plan has been identified by a stakeholder group as a National Plan, due to the human-induced distribution of bontebok across South Africa.

During the bontebok BMP-S Development Workshop the participants expressed their view of the desired state for bontebok as:

“The conservation of a secure and well managed* bontebok meta-population.”

**** Well managed: an increase in pure Bontebok numbers especially in their indigenous range, sustainable use of habitat and species, securing genetic integrity, researched and regulated to inform decision making and planning.***

This Desired State is aimed at creating a long term Vision for successful conservation of this species and this is to be achieved by a set of associated Objectives. These objectives capture the operational details of how to go about realising the long term conservation of bontebok. Each objective has a set of associated Targets which in turn are given a time frame.

The workshop ensured that each Objective and associated Target were aimed at the long term survival of the species in the wild. The populations were scrutinised holistically to avoid irreplaceable loss in the event that one or more populations are lost due to unforeseen, possibly unavoidable catastrophes, and ecological functionality was not lost by conserving small isolated populations but rather large robust ones. Lastly the Objectives and Targets were developed to include human socio-economic and cultural needs and desires, in a manner consistent with the Norms and Standards for BMP-S. This plan recognises that populations within and outside the NDR can contribute to the conservation of the species as long as owners and managers of bontebok populations contribute to the meta-population Plan for this species and as guided by the Guidelines

for Using the IUCN Red List Categories and Criteria, Version 12, February 2016. Wild populations are those populations inside the NDR and may include populations outside the NDR which meet all the IUCN criteria. Managed sub-populations dependent on conservation measures that are largely directed at mitigating human impacts may be considered “wild” and included in the conservation assessments provided that bontebok would not go extinct in the absence of “intensive management”.

1.4 Objectives of the BMP-S

The prioritised Strategic Objectives of the bontebok BMP-S are as follows.

- To conserve the genetic integrity and diversity of bontebok;
- To prevent further habitat loss and habitat degradation, and establish and maintain historic habitat connectivity;
- To establish and maintain effective communication and awareness between and among stakeholders; and
- To investigate and conduct research aimed at supporting adaptive management and the implementation of actions to promote and ensure bontebok conservation.

1.5 Benefits of the BMP-S

The foreseen benefits of implementing this BMP-S are:

- Ensuring the bontebok meta-population inside and outside (nationally) the NDR increases and is resilient to threats faced;
- Ensuring that harvesting and off-takes of bontebok are sustainable;
- Scientific sound meta-population management is implemented and through this the full extent of genetic diversity is represented throughout the population;
- To facilitate the establishment and maintenance of a National Database to advise on the status of populations;
- Identify priority conservation land for bontebok conservation within the NDR;
- Promote collaboration and cooperation between government agencies as well as between government and the private sector;
- Coordinated management actions; and
- Identify accountable parties and clearly define roles and responsibilities.

1.6 Anticipated Outcomes

The anticipated outcomes of the management plan are as follows:

- The management of the bontebok population in and outside the NDR to ensure the long term survival of this subspecies;
- A co-ordinated national approach to bontebok conservation in and outside of the NDR in terms of management, monitoring and research;
- The halt of the loss of habitat and ultimately ensure a steady increase in conserved habitat and rehabilitation of degraded areas for re-introduction of bontebok within the NDR;
- Highlight research and communication priorities and identify appropriate parties to implement actions;
- A National Database of population distributions and national testing and profiling protocols for bontebok;
- The identification and immediate elimination of hybrids of this species to maintain the economic and conservation value of bontebok; and
- Promotion of bontebok as an iconic flagship conservation species for Renosterveld vegetation, the CFR and the World Heritage Sites found there.

2) SPECIES BIOLOGY AND BACKGROUND INFORMATION

2.1 Species ecology and biology

2.1.1 Taxonomic description

Taxon name: *Damaliscus pygargus pygargus*

Common names: Bontebok

Taxonomic level: Subspecies *pygargus*

The genus *Damaliscus* consists of two subspecies, namely blesbok (*D. pygargus phillipsi*) and bontebok (*D. pygargus pygargus*), belonging to the Alcelaphini Tribe (Van Wyk et al. 2012; Vrba 1979). Climatic and geological changes in the distant past resulted in a split between the two sub-species of *Damaliscus pygargus*.

Bontebok are medium-sized antelope measuring 80 to 100 cm at the shoulder. Adult males have a mean mass of 61 kg and females weigh less and are slightly smaller. Both males and females carry black ridged horns that curve backward and outward and then slightly forward towards the unridged tips. The horns of the females are more slender and generally lack the thickening at the base as in the case of the males. Adult males are generally darker in colour with their white scrotums being conspicuous (Skinner and Chimimba 2005). The back is rust brown, with the rest of the body dark brown to nearly black and the underside white. The sides of the face and neck, the flanks and the upper parts of the limbs are glossed purple (the purple gloss is absent in blesbok). The front of the face is white from the base of the horns to the nose, with variation in some animals (< 20%) where a brown band divides the face blaze. There is a distinctive white patch at the base of the tail which is light brown in blesbok.

2.1.2 Distribution of bontebok

Historic

A significant body of evidence exists globally indicating that recurring, multi-scale climate change events (glacials and interglacials), interlaced with marine regressions and transgressions, and interacting with oscillating and contingent environmental change during the Early (± 2.6 Million years ago; Mya) to Late (± 11.7 Thousand years ago; kya) Pleistocene, have shaped not only the southern African landscape observed today, but has also led to multiple shifts in the floral and faunal components of these landscapes (e.g. Steele 2007; Faith and Behrensmeyer 2013; Carr, Chase and Mackay 2016; Hoag and Svenning 2017; Helm et al. 2018). Steele (2007) records that for African landscapes, arid habitats expanded during cool, dry periods, and contracted again when more moisture was available and this led to repeated fragmentation of natural habitats and ecosystems, which isolated plants and animals, and their habitats, leading to an increase in biodiversity. According to this paper an essentially modern fauna was present in southern Africa by approximately 270 kya. The changes in faunal communities in response to Late Pleistocene glacial cycles are best documented along the southern and west coasts of South Africa (Klein 1980, in Steele 2007), and most notably is the overwhelming abundance of grazing species, especially equids and alcelaphines (hartebeest, wildebeest and antelope allies). As demonstrated at Nelson Bay Cave (modern-day Eastern Cape), around 18.5 -12 kya, the fauna on the southern coast of South Africa were dominated by grazing ungulates, including quagga, alcelaphines (hartebeest, wildebeest and allies), long-horned buffalo and springbok; species preferring open habitats. Steele (2007) notes that none of these taxa were present in the vicinity of the site historically, indicating that open grasslands were much more common during this period (18.5 -12 kya) than historically. Importantly, it should be noted that this period follows the Last Glacial Maximum (21 kya) during which the marine regression and reduced sea levels exposed a broad southern coastal plain or "palaeo-Agulhas Bank" of around 60,000 km² (Faith and Behrensmeyer 2013). Bathymetric evidence (Compton 2011) exists that large mammals would have been allowed to migrate from and between this southern coastal plain and the western coastal plain (modern-day Swartland-West Coast region) around modern-day Cape Hangklip and the Cape Peninsula in the West, as well as between the interior and the exposed southern coastal plain in the East (modern-day Eastern Cape) (Faith and Behrensmeyer 2013) facilitated by the approximately 40-60 km wide coastal portal near modern-day Plettenberg Bay (Compton 2011). Palaeo-environmental records, independent of the large mammal assemblages, provide evidence for the expansion on the southern coastal

plain of grasslands, while fossil evidence indicates that the large mammal community was species-rich and dominated by large grazing ungulates, including equids and alcelaphine antelopes (Klein 1983; Klein and Cruz-Urbe 1987; Rector and Reed 2010; Faith 2011).

Turning attention to subsequent events on the exposed palaeo-Agulhas Bank, Compton (2011) records that rapidly rising sea levels during the period following the Last Glacial Maximum created vicariance events by flooding and isolating the southern coastal plain from both the western coastal plain in the West and the interior to the East with a subsequent altered rainfall regime and the contraction of grasslands. The fossil record shows the replacement of open-habitat grazers by small browsing species typical of the Cape Floristic Region shrublands, resulting in an essentially modern fauna in place by approximately 5,000 years ago (Klein 1983; Faith 2012).

In testing their third prediction that “Lineages adapted to open grassland habitats will be characterized by elevated incidences of extinction and speciation over the long term.”, Faith and Behrensmeyer (2013) state that this would result from the repeated expansion and contraction of grassland habitats during glacial-interglacial cycles together with the isolation of grassland species on the southern coastal plain during marine transgressions.

They found that while bias towards extinctions among alcelaphines and antilopines is significant in the Cape Floristic Region, although evidence is abundant (loss of 23% of ungulates since the Last Glacial Maximum), “the CFR record provides only one example for the origination of a new taxon, and only at the subspecies level. *Damaliscus dorcas* is an open-habitat grazer that includes two allopatric subspecies: bontebok (*Damaliscus dorcas dorcas*), which is endemic to the CFR, and blesbok (*D. dorcas phillipsi*), which is found in the South African interior.” [Note taxonomic change: *Damaliscus dorcas dorcas* = *Damaliscus pygargus pygargus*; *Damaliscus dorcas phillipsi* = *Damaliscus pygargus phillipsi*] (Grubb 1993).

Further evidence indicates that *D. dorcas* (= *pygargus*) first emerged in the interior of South Africa around the early Pleistocene (± 1.4 Mya) (Vrba 1997; Sutton et al. 2009) and later migrated to the Cape Floristic Region during a middle Pleistocene marine regression, when the so-called “eastern portal” must have facilitated this migration. In support, the earliest record of *D. dorcas* in the Cape Floristic Region dates back to approximately 151,000 years ago (end of the middle Pleistocene). Faith and Behrensmeyer (2013) accordingly conclude that the subsequent isolation of faunal assemblages on the southern coastal plain during “interglacial highstands” allowed allopatric divergence at the subspecies level.

There is currently no evidence that the historic distribution range of the bontebok (in its current form and taxonomic status; *Damaliscus pygargus pygargus*) included either the western coastal plain or the grassland interior of the modern-day Eastern Cape Province. Steele (2007) concludes that “... in the fossil record, species are found in places where today their descendants live hundreds, if not thousands, of kilometres away, indicating that their past ranges were either completely shifted to different location or expanded to encompass new locations.”

It therefore stands to reason that, based on currently available palaeontological, fossil and other scientific evidence, bontebok in its current form and taxonomic status is a result of multiple and recurring climate change events, resulting in marine regressions and transgressions on the South African southern coastal plain and surrounds, eventually allowing for and resulting in the allopatric speciation of this endemic taxon to the modern-day Western Cape Province of South Africa.

Recent

Currently their natural distribution range consists of vegetation types which are Critically Endangered, Endangered or Vulnerable. Suitable natural habitat within the NDR is thus limited to the remaining Renosterveld patches in the Overberg region between 60-200 m above sea level. In the NDR the population is fragmented into small subpopulations restricted by fences. The NDR for bontebok is delineated in Figure 2.1.2.2.

The Guidelines for Using the IUCN Red List Categories and Criteria, Version 12, make provision for the acknowledgement of including benign introductions outside the NDR to contribute to the conservation of the species according to a set of criteria: sub-populations within the same ecoregion may be included. Due to the status and limited availability of habitat for bontebok within the NDR, benign introductions are required. This

range is referred to as the extended natural distribution range (ENDR). This has enabled additional utilisation of this species by private land owners and the creation of a buffer population from which to augment populations within the NDR and thus contribute to a meta-population management approach.

NATURAL DISTRIBUTION RANGES: Bontebok and Blesbok

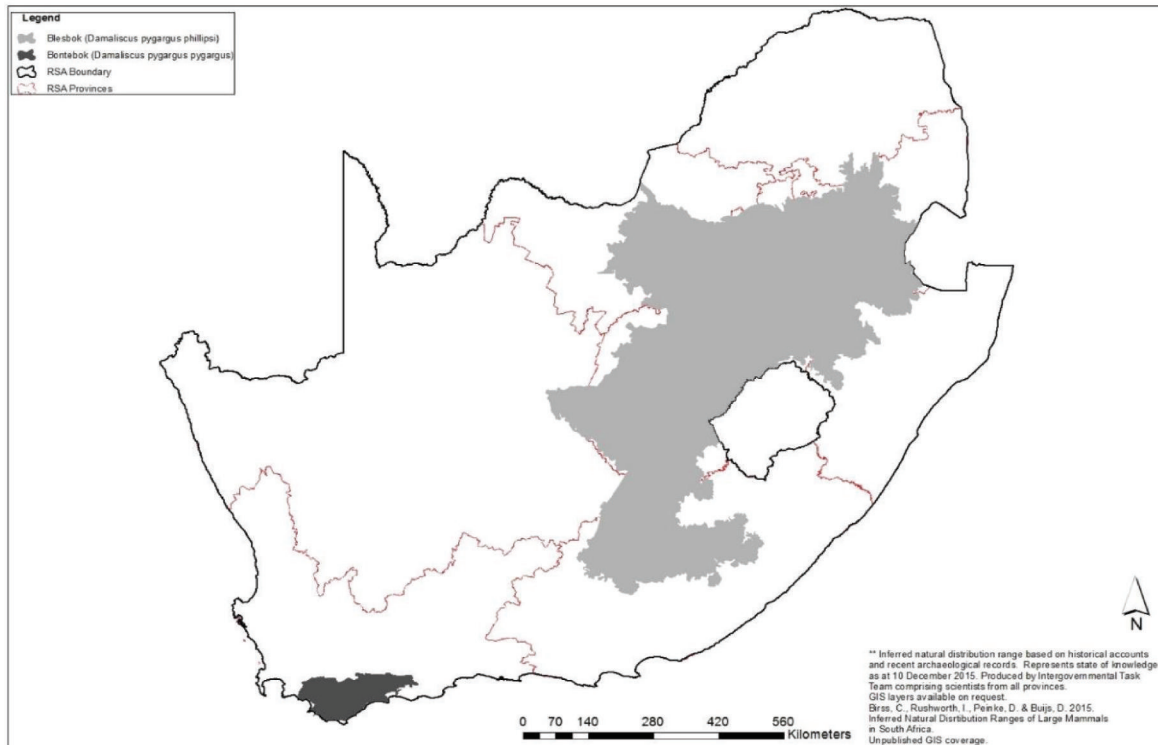


Figure 2.1.2.1 Historical distribution of bontebok and blesbok (source: Birss *et al.* 2015).

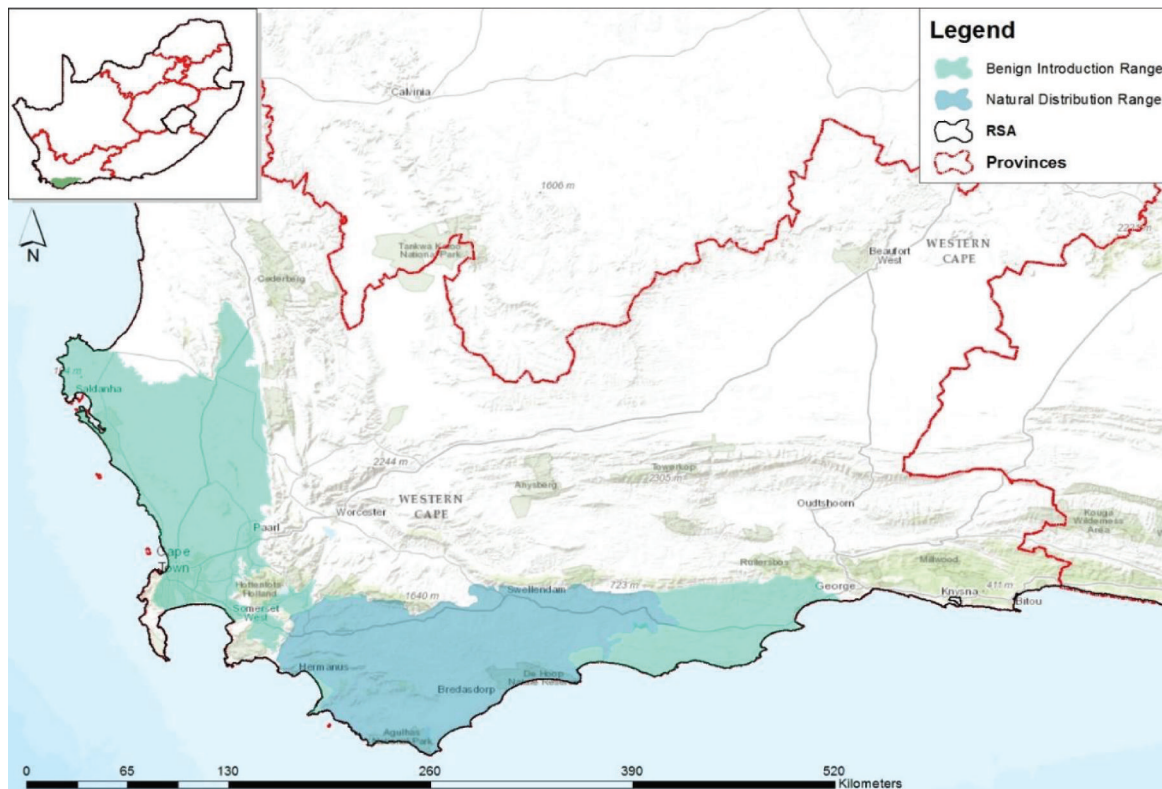


Figure 2.1.2.2 Natural Distribution and Benign Introduction Range for bontebok.

2.1.3 Status of bontebok sub-populations

Historically, conservation organisations in South Africa aimed to promote the conservation and sustainable use of bontebok populations on sufficient habitat within the NDR. The threatened status and limited availability of habitat for bontebok within the NDR necessitated the extension of their range according to the IUCN criteria, thereby enabling additional utilisation of this species by private land owners and the creation of a buffer population from which to augment populations within the NDR and contribute to a meta-population management approach. Today bontebok occur in a number of protected areas both in and outside the NDR. These include Bontebok, Table Mountain and West Coast National Parks (all genetically tested), De Hoop Nature Reserve and Denel Overberg Test Range (largest subpopulation within the natural range), and Tsolwana Nature Reserve in the Eastern Cape Province.

The total estimated population of Bontebok on government-managed protected areas is 885 individuals. Of these, 457 occur in the South African National Parks’ (SANParks) four parks (Agulhas, Bontebok, Table Mountain and West Coast National Parks). The combined population for De Hoop Nature Reserve and the Overberg Test Range is estimated at about 444 individuals. Estimates place the population number within the indigenous range at ± 905 animals across both protected areas (Table 2.1.3) and on private land. Approximately 2610 animals occur in the Western Cape Province and a total of approximately 9150 is distributed throughout South Africa (Figure 2.1.3).

Table 2.1.3: Summary of population size estimates for bontebok (*Damaliscus pygargus pygargus*), on protected areas

Property Name	Property Type	Management Authority / Conservation Agency	In Natural Distribution Range	Population Estimate
---------------	---------------	--------------------------------------------	-------------------------------	---------------------

Table Mountain National Park	Protected Area	SANParks	No	93
Bontebok National Park	Protected Area	SANParks	Yes	190
West Coast National Park	Protected Area	SANParks	Yes (ENDR)	75
De Hoop Nature Reserve – Overberg Test Range	Protected Area	CapeNature	Yes	499
Tsolwana Nature Reserve	Protected Area	Eastern Cape Parks and Tourism Agency	No	181

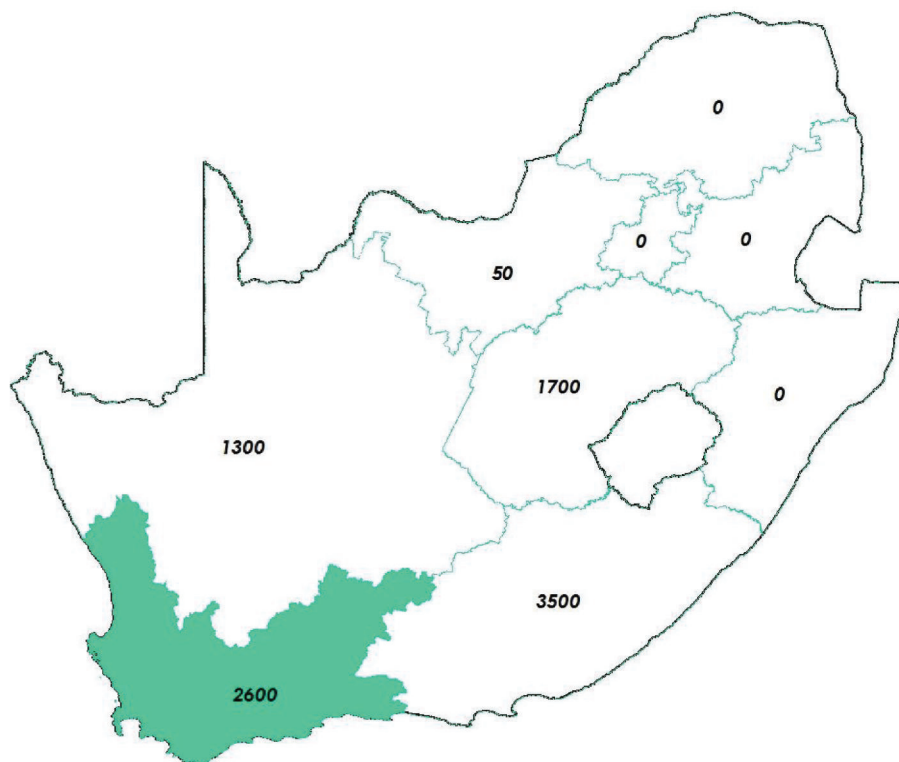


Figure 2.1.3 Distribution records for bontebok sub-populations per Province.

2.1.4 Genetic status of bontebok sub-populations

Genetic diversity, the primary component of adaptive evolution, is essential for the long-term survival of a population. Previous genetic studies indicate low genetic diversity, population fragmentation and hybridisation with blesbok, (Van Wyk *et al.* 2016; Van Wyk *et al.* 2012). Secondary, artificial contact between the two subspecies, brought about through translocations, resulted in deliberate and accidental hybridisation. A recent study by Van Wyk *et al.* 2016 investigated the hybridisation rates in animals sampled across South Africa and found that approximately 25% of the samples were hybrids, but more importantly, also found that approximately 67% of the localities sampled contained hybrids. The study also found that these hybrids were

predominantly a result of secondary hybridisation between hybrids and either bontebok or blesbok, with no first generation hybrids detected.

Apart from the low genetic diversity and prevalence of hybridisation, the genetic integrity of bontebok is further threatened by biased selection pressures for trophy and or breeding animals, which are managed for high production outputs. Stocking rates and sex ratios which favour high production outputs are favoured. The majority of subpopulations on private land are small (<15 animals) and have sex ratios of 1:3 to 1:7 (males: females). Maintaining an acceptable inbreeding coefficient in populations, requires the maintenance of an effective population size of 50 animals, stocked at a 1:1 ratio (Allendorf *et al.* 2001; Du Toit *et al.* 2010; Frankham *et al.* 2002).

Figure 2.1.4 indicates the distribution of bontebok sub-populations in the Western Cape Province and highlight those subpopulations larger than 15 animals in the NDR and EDR. A maximum of 1892 animals occur in 33 subpopulations (of which only 7 have been genetically tested to contain no hybrids).

Detailed information on the status of all bontebok subpopulations in South Africa is not currently available but the establishment of a centralised georeferenced genetics database for bontebok has been identified as an action to pursue to effect the outcomes of the BMP-S.

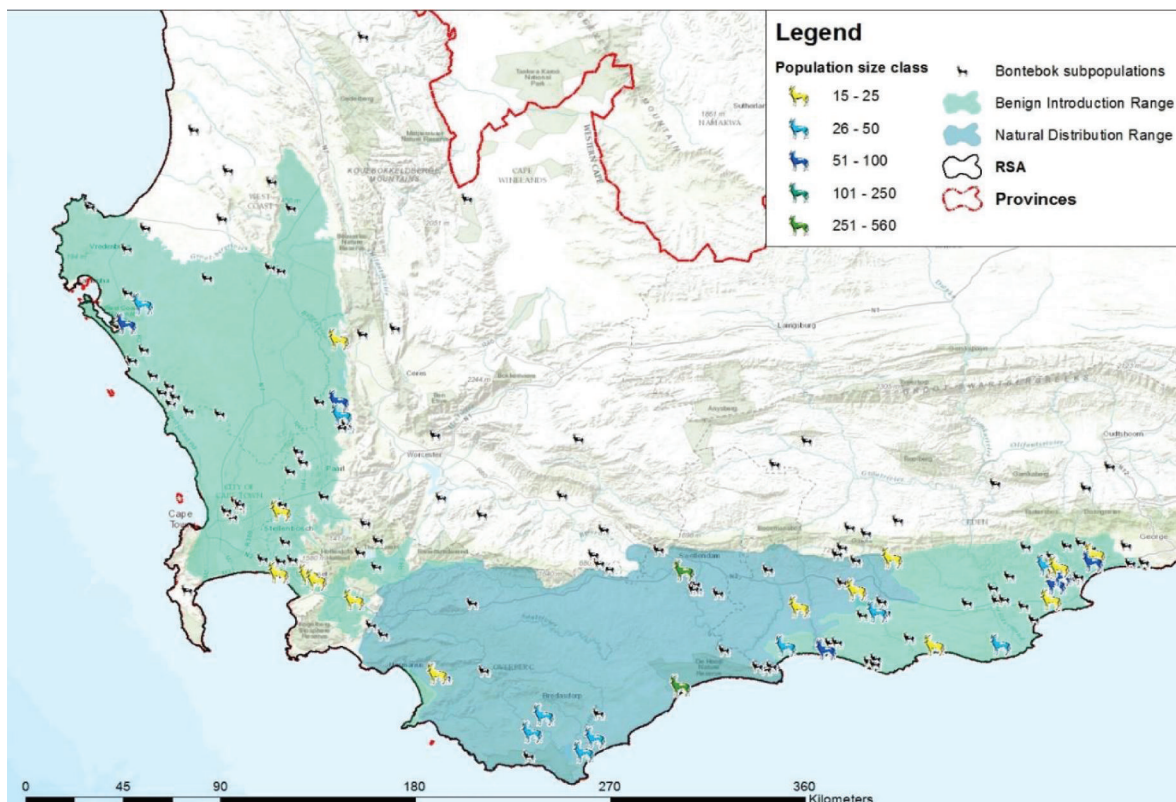


Figure 2.1.4 Bontebok sub-population distribution and size classes in the Western Cape Province.

2.1.5 Life history and reproduction

Bontebok are sedentary-dispersed in that populations segregate into female and bachelor herds with permanent territorial networks (Estes 1992). Female home ranges typically include 2 – 3 territories and territorial males almost always accompany a herd. Territorial males tolerate yearling males, while large bachelor herds form without fixed home ranges, inhibiting dispersal. Male territories range from 4 – 40 hectares with an average spacing of 300 meters between males. Territories are resource based, in other

words, grazing lawn territories are demarcated with dung middens. This is only done by mature males, who only defend activity centers, leaving large areas where bachelor males can circulate with little or no harassment. Social structure consists of the territorial males, female herds and bachelor groups. Young males leave the female herd of their own accord at 12 months and can remain solitary but usually join bachelor groups until sexual maturity around 5 years of age. Older males are displaced from their territories and often find refuge within a bachelor group. There is no hierarchy in a bachelor group and fighting is rare. Territorial battles between rams are ritualistic and bouts end when either ram walks away or when one is chased off. This is true of large populations in natural free roaming areas but in smaller populations with restricted area, ram deaths due to fighting are known to occur, as well as rams killing their own male offspring (M. D'Alton 2016, personal communication).

The bontebok is a short-day seasonal breeder and the conception rate is influenced by rainfall before the breeding season (Novellie 1986). Gestation is approximately 240 days and single lambs are born in spring and early summer when females do not isolate from herds. Bontebok have a follower-calf strategy – calves are not hidden but follow mothers within minutes (Skinner and Chimimba 2005). Females become sexually mature at just over 2 years of age and have their first lambs at about 3 years old. A hierarchy exists in the female herd and status is obtained by threat postures and battling with horns. Female herds typically consist of 8 females and their yearlings and are visited by males during the breeding season (Skinner and Chimimba 2005). In captivity bontebok have been known to live for up to 15 years.

2.1.6 Habitat requirements and resource assessment

Bontebok show an exclusive preference for grazing on short grass in the low-lying, grassy coastal plains and Renosterveld within the CFR and Fynbos Biome biodiversity hotspot (Myers et al. 2000). Due to major transformation of this part of the biome (Margules 2000), suitable habitat for bontebok is limited to the remaining Renosterveld patches in the NDR. Bontebok avoids tall woody vegetation with low visibility and areas with steep slopes, preferring open areas with low shrubs (Novellie 1987). Fragmented populations are currently found primarily on sub-optimal habitat and old cultivated lands where they appear to do relatively well.

Research conducted in Bontebok National Park and the Cape of Good Hope Section of Table Mountain National Park found that bontebok has a clear preference for recently burnt veld and fire breaks (Strauss 2015). They utilise veld up to four or five years following fire and then revert to grazing lawns made up of *Cynodon dactylon*. Although predominantly short grass grazers, bontebok have been known to browse small shrubs and restios. They need to drink regularly and are dependent on accessibility of drinking water in the dry, hot summer (Luyt 2005).

Preliminary investigations indicate that certain protected areas may have reached their stocking rate limits for bontebok. Some areas are limited by size and others by competition with other herbivorous species competing for resources. However, there are protected areas within the NDR with suitable habitat for bontebok and which can contribute to future conservation goals of this species (for example, Agulhas National Park).

Ideally, conservation areas should be large with sufficient varied habitats to sustain populations throughout summer and winter (Penzhorn 1971; Penzhorn and Novellie 1991). Given the success of bontebok on old lands, it has been suggested that in order to mitigate changing land use and climate, the use of old agricultural areas may be suitable for stocking bontebok (M. D'Alton 2016, personal communication). It was also highlighted that habitat selection (including availability) must not be viewed in isolation since water, mineral licks, shelter, as well as social factors, are also known to influence habitat use in large herbivore species (Winkler and Owen-Smith 1995). There appears to be considerable scope for increasing the area and number of sub-populations of bontebok in the NDR and ENDR that can contribute to the meta-population.

2.1.7 Known diseases

The survival of the bontebok has been threatened by parasites throughout its management history. Barnard & Van der Walt (1961) reported on severe verminosis in bontebok while located at Bredasdorp, and that Conical Fluke (*Paramphistomum* sp.), Wireworm (*Haemonchus* sp.), Brown Stomach Worm (*Ostertagia*) and

Bankrupt Worm (*Trichostrongylus* sp.) were found in great numbers (Zumpt and Heine 1978). Bontebok is also known to show a general weakness and signs of ataxia in spite of them appearing to be in reasonable condition (Barnard and van der Walt 1961). This is thought to be related to nutrient deficiencies. A series of studies was done by the Onderstepoort Veterinary Research Institute which identified parasites (Helminths, Arthropods, Nematodes, and Ixodid ticks) found in bontebok, in Bontebok National Park in Swellendam (Boomker and Horak 1992; Boomker et al. 1983; Boomker 1990; Horak and Boomker 1998; Horak et al. 1982; Horak et al. 1997; Horak et al. 1986; Ortlepp 1962; Verster et al. 1975). A 10-year study of Ixodid tick infestations in Bontebok National Park showed that bontebok harboured eight species, none of which were alien species, despite translocations having occurred and the presence of alien species outside the park (Horak et al. 1997). Another study established that first stage larvae of a fly species (a large *Gedoesia* sp.) found in the nasal sinuses of bontebok can cause severe ocular lesions in the eyes of abnormal hosts, such as grey rhebok (Horak et al. 1982). Pulpy kidney (*Clostridium*) has been known to cause high mortalities in bontebok which were kept in bomas for long periods of time (Dalton 2016, personal communication).

Nematodes primarily colonizing the lung (lungworms), including *Pneumostrongylus* sp and *Muellerris capillaris*, have been reported in antelope species including bontebok. Mortalities in bontebok have been described with *P. cornigerus* infection. *Bronchonema magna* (*Dictyocaulus magna*) is non-pathogenic in its natural host springbok but does induce pathology in contact species such as bontebok. Under free-ranging conditions and established populations, such as Bontebok National Park, these infestations are sub-clinical and mortalities as a direct result of lungworms are rarely recorded. During periods of capture and relocation these infestations can become clinical as a result of stress-induced immunosuppression.

The lungworm *Dictyocaulus magna* was not recorded from bontebok before they were transferred to Swellendam. During 1960, 20 springbok were also introduced and *D. magna*, "... a well-known parasite of the springbok ..." (Verster et al. 1975) was undoubtedly introduced at the same time. In this case, the introduction of springbok into the BNP, beyond their original range was not only ill-conceived but proved to be detrimental to the bontebok (de Graaff and Penzhorn 1976).

2.2 Population statistics and trends

Successful conservation action for bontebok in the NDR and ENDR within the Western Cape has seen the numbers of this subspecies increase to a current estimate of about 1650 individuals. Assuming a 70% mature population structure, about 1150 of these are mature individuals with 46% of these individuals occurring on protected areas (Table 2.2.1) in contrast to private properties. A further 7500 individuals survive on properties outside the NDR of the species throughout South Africa. Bontebok are tolerant of human activities and adapt to changes in the landscape and readily utilise transformed landscapes with old fields of short grass areas. The major threats to this species are the availability of habitat within its natural range (thus limiting population expansion) and potential hybridisation with introduced blesbok. These threats need to be managed through a sound, scientifically-informed management policy. At present, the population in the NDR is not increasing significantly.

Table 2.2.1: Summary of population size estimates for bontebok (*Damaliscus pygargus pygargus*), both inside and outside the natural range. The percentage of mature individuals per subpopulation is provided.

Province	Type	Inside natural distribution range	No of reserves / properties	Subpopulation total (2013-2015)	Mature 75%
Western Cape	FP	Yes	4	686	515
Western Cape	PR	Yes	17	219	164
Western Cape	FP	No	2	199	149
Western Cape	PR	No	124	1506	1130
Eastern Cape	FP	No	1	181	136

Eastern Cape	PR	No	68	2605	1954
Northern Cape	PR	No	27	1251	938
Free State	PR	No	22	812	609
North West	PR	No	1	8	6
Grand total	All	Both	266	7467	5227
Total natural range	FP	Yes	4	686	515
Total natural / extended natural range	FP	Both	6	885	664
Total inside natural range	FP+PR	Yes	21	905	679

“FP” refers to formally protected areas while “PR” refers to private properties. “Private” includes privately protected areas, wildlife ranches or game farms.

2.3 Research

Research on the bontebok has been sporadic over the years with the majority of research conducted from 1970-1990. A scientific literature review produced a list of important research findings, outcomes and recommendations to be taken into account in designing action plans for this BMP-S. Numerous topics relating to and including bontebok have been studied. Aspects well-studied were bontebok life history, demography, population dynamics, genetic purity/distinctiveness, feeding ecology, fecundity, reproduction, territorial behaviour, mating and drinking behaviour, parasitology, and the sex pheromones from the pedal gland of bontebok (Burger et al. 1976.; Burger et al. 1977; Fujimoto et al. 1991; Kovalev et al. 1986). These research findings and recommendations are incorporated into the relevant sections of this document. Appendix 3 is a table of all research conducted on or related to bontebok.

The South African National Biodiversity Institute: National Zoological Gardens (SANBI: NZG), a formerly declared National Research Facility of the National Research Foundation (NRF) since 2004, is uniquely placed to generate new knowledge, core technologies and data pools/collections commensurate with international standards. In its role as a national research facility, the SANBI: NZG assist agencies and organisations, in collaboration, to fulfil their collective mandates for the conservation of biodiversity, ultimately enhancing the collective efforts in southern Africa for the conservation of regional biodiversity (Kotze and Nxomani 2011). The SANBI: NZG has built up a unique resource to conduct and promote molecular genetic research in Africa, in response to a need to understand the relationships between the degree of genetic diversity, molecular diagnostics, phylogenetics and genetic factors that determine population viability of threatened species as a result of habitat fragmentation. National genetic databases have been established for a variety of species, including bontebok. The implementation of effective meta-population management for bontebok aimed at conserving and maximising genetic diversity of the meta-population, is heavily reliant on the undertaking to implement focussed applied research in partnership with the SANBI: NZG and other research institutions.

2.4 Utilisation and socio-economic context

Historically, the bontebok had restricted distribution to the coastal plains of the Western Cape. Here, according to Skead (1980) bontebok were almost totally destroyed by hunters in the late 1700 to 1800s. Excessive hunting and habitat loss has reduced the population to a few individuals by the late 1930s. A concerted conservation effort by local farmers and conservation authorities resulted in the declaration of the Bontebok National Park and the establishment of bontebok populations in the Western and Eastern Cape provinces. This charismatic species is much loved by South Africans and is often seen as an iconic species for conservation efforts.

The South African game ranching and hunting industry contributes significantly to the South African economy (Furstenburg 2016). However, the role of wildlife ranching is not prominent in the NDR of bontebok. The landowners within the natural range who want to contribute to the conservation of bontebok are affected by

the bontebok industry outside of the NDR: (1) the value of the species has increased in the last five years and the demand for exports from the NDR have increased. As a result, they cannot afford to buy and stock bontebok; and (2) with the increased demand more landowners are willing to stock bontebok to breed them and supply the industry.

Judicious management and export of bontebok from the NDR is needed to ensure that the meta-population is not negatively impacted. Evidence shows that bontebok and blesbok have been crossbred for trophy hunting purposes (Lindsey et al. 2007), mainly in the form of colour morphs and extended horn lengths. The threat of hybrid and artificial colour morph selection must be addressed to conserve the integrity of this iconic species (Gray 1971).

Bontebok are currently exported live or hunted both in- and outside the NDR. Live exports impede the contributions to the conservation of bontebok in the NDR. The Western Cape Province Nature Conservation Ordinance No. 19 of 1974 lists bontebok as Protected Wild Animal. This implies that private landowners may be issued with Certificates of Adequate Enclosure (exemptions) for bontebok, implying that every activity (harvest/hunt/export) is not regulated but exempted from separate applications. Given the limited genetic diversity of bontebok, a strict harvest regime needs to be set in place to prevent genetic loss or contamination and possible eventual extinction. Harvesting activities on private land are mainly for eco-tourism, trophy hunting and breeding of trophy animals.

Careful management of the natural veld is needed in the NDR as improved grass cover for bontebok grazing may negatively impact plant species diversity in the Renosterveld (Novellie and Kraaij 2010).

2.5 Conservation measures

The NDR for bontebok is in the Western Cape, with CapeNature the provincial conservation authority of the Western Cape Province. The aim of the Western Cape Bontebok Conservation, Translocation and Utilisation Policy (BCTUP) aims to ensure the conservation and sustainable use of bontebok within the NDR, supplemented by sound meta-population management, supporting the improvement and rehabilitation of contiguous available habitat and effective mitigation of the threat of hybridisation with blesbok.

A phenotypic test was developed by Fabricius *et al.* (1989), and titled: “*A discriminant function for identifying hybrid Bontebok X Blesbok populations.*” The method allows for the identification of hybrid populations and in some cases hybrid individuals. The characteristics chosen as criteria emphasised the importance of the white buttocks, upper legs and belly. Hybrid animals were expected to show some features of each subspecies but it was not expected that all hybrid populations/individuals will be rejected using this test. Using this phenotypic test, bontebok purity certificates were issued for tested populations. The United States Fish and Wildlife accepted these purity certificates as verification for issuing hunting trophy import permits. Shortfalls in the certification process allowed for hybrid animals to be taken as trophies as these hybrid animals may be larger animals (in the case of bontebok). This has a potential to influence the standards set by Safari Club International (SCI). The reliability of the phenotypic test to consistently identify hybrid individual animals and populations is no longer supported by CapeNature as well as the DEDEAT (Eastern Cape). During a National Workshop on Bontebok Purity Testing and Management held in 2009, the NZG of South Africa was mandated to further develop a scientifically defensible genetic test for bontebok and blesbok hybridisation using microsatellite (DNA) markers. The genetic test developed by researchers at the NZG (Van Wyk et al. 2013) is supported by peer reviewed scientific publications and forms the basis for the update of the CapeNature policy and the development of the WRSA protocols.

Bontebok currently occur in 3 national parks (Bontebok, Table Mountain and West Coast National Park) and one nature reserve (De Hoop Nature Reserve) within the NDR and ENDR. In 2014 DNA testing of all four subpopulations was started. After confirmed purity of all three subpopulations in SANParks it undertook to translocate 5 rams between the three parks to mimic gene flow between populations and it is envisaged that this will be rolled out to include De Hoop Nature Reserve in the future. All animals sold from Bontebok and Table Mountain National Parks to private land owners have also been tested.

2.5.1 Meta-population management

The implementation of meta-population management processes may improve the persistence of mammals in fragmented habitats (Olivier et al. 2009). A meta-population is defined as a group of geographically isolated populations of the same species that may exchange individuals through dispersal, migration or, when implemented as a management strategy, human-controlled movement and the availability of empty habitats that are largely connected (Hanski 1999; Olivier et al. 2009). Human interventions become necessary when individuals no longer have the ability to immigrate, emigrate and recolonise empty patches (Akçakaya et al. 2007). Where extensive areas are needed to hold a viable population, a managed meta-population approach has been proposed for large herbivores in South Africa, (Elmhagen and Angerbjörn 2001). However, when there are small isolated populations with a high extinction risk, discrete habitat patches large enough to hold breeding sub-populations (Hanski 1999) are needed in conjunction with ecological processes working at both local and regional (meta-population) scales (Hanski 1999). A managed meta-population approach can then be used to prevent inbreeding problems (Elmhagen and Angerbjörn 2001).

In 2007 Akçakaya et al. proposed that conservation needs to adopt the meta-population approach and concepts enabling the assessment of the persistence of a species that happens to exist in a meta-population, either naturally or due to habitat loss and fragmentation. It must be noted that the demographic properties of subpopulations in different population networks must be investigated on a case by case basis in order to contribute to the conservation and management of large mammals in fragmented habitats (Elmhagen and Angerbjörn 2001). It must be acknowledged that not all populations with patchy distributions and some degree of connectivity are meta-populations. Conservation should seek to mimic dispersal through reintroduction and translocation, and the establishment of habitat corridors by conserving or restoring the habitat between existing populations to increase dispersal.

Effective meta-population management for bontebok by the various conservation agencies involved from each province where bontebok occur, should aim to conserve the allelic diversity by promoting and maintaining genetic diversity within and between the relevant sub-populations of the meta-population. Finally, the management and monitoring of the bontebok meta-population should be guided by this BMP-S and all agencies, private and corporate landowners, should strive to promote the conservation of the bontebok. Only a collaborative and focused science-based effort, supported by sound management principles and best practice will ensure the success and future survival of the species.

2.5.2 Non-detriment Finding

The Scientific Authority of South Africa, as established in terms of Section 60(1) of the NEM: BA, published a Non-Detriment Finding (NDF) Assessment for public input on 10 September 2015 (Gazette vol. 603, no. 39185). A NDF is a science-based risk assessment measuring a species' vulnerability to trade against its management system to ensure that any offtake will not be detrimental to the long term survival of the species and that the species is maintained throughout its range at a level consistent with its role in the ecosystem and well above the level at which the species might become eligible for inclusion in CITES Appendix I.

The non-detriment finding undertaken for bontebok demonstrated that legal local and international trade in live animals and the export of hunting trophies at present poses a moderate risk to the survival of this subspecies in South Africa, which can neither be deemed detrimental nor non-detrimental. This moderate risk however is mostly due to a lack of management and monitoring of bontebok off-takes. The NDF recommended the development and effective implementation of a Biodiversity Management Plan (BMP) in terms of section 43 of the NEMBA to improve both management and monitoring. It is further recommended by the NDF that the BMP includes a meta-population management plan and addresses the following:

1. The long term monitoring of harvest in the form of translocation and trophy hunting,
2. Guidelines for the management and regulation of harvest,
3. Incentives to increase habitat conservation benefits from the harvest of bontebok, especially within the natural and extended natural distribution range.

2.6 Conservation status and legislative context

In South Africa, legislative jurisdiction regarding the conservation and management of wildlife is shared between the national and provincial governments. The Constitution mandates that “nature conservation, excluding national parks, national botanical gardens and marine resources,” is one of the functional areas in which there is concurrent national and provincial legislative jurisdiction.

South Africa has nine provinces: Eastern Cape, Free State, Gauteng, KwaZulu-Natal, Limpopo, Mpumalanga, Northern Cape, North West, and Western Cape. A great deal of legislative and executive jurisdiction over issues of conservation and management of wildlife, including regulation of imports and exports, is exercised by these provincial governments. National government wields significant legislative jurisdiction over the protection of wildlife, in large part to create national uniformity on the matter.

The NEM: BA and its subsidiary legislation put in place protections for various species that are threatened or otherwise in need of protection. It also provides the authority for consolidating fragmented biodiversity legislation in the country through the establishment of national norms and standards specific to certain particularly vulnerable animals. Enforcement of the NEM: BA and its subsidiary legislation is shared across various tiers of government (Goitom 2013).

2.6.1 International obligations Convention on Biological Diversity (CBD)

South Africa is a Party to the CBD. Parties to the CBD adopted the Strategic Plan for Biodiversity 2011-2020, in 2010 in Nagoya, Japan, with the purpose of inspiring broad-based action in support of biodiversity over the following decade by all countries and stakeholders. In recognition for the urgent need for action the United Nations General Assembly also declared 2011-2020 as the United Nations Decade on Biodiversity. The Strategic Plan comprises a shared vision, a mission, strategic goals and 20 targets and serves as a framework for the establishment of national and regional targets, promoting the three objectives of the CBD.

The development and implementation of this BMP-S addresses Strategic Goal C: Improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity. This BMP-S specifically aims to contribute to the Target 12: By 2020 the extinction of known threatened species has been prevented and their conservation status, particularly to those in decline, has been improved and sustained. This target specifically related to IUCN listed threatened species and has two components:

Preventing extinction. Preventing extinction entails that those species which are currently threatened do not move into the extinct category; and

Improving the conservation status of threatened species. An improvement in conservation status would entail a species increasing in population to a point where it moves to a lower threat status.

Progress towards this target would help reach other targets contained in the Strategic Plan, including Target 13. Further actions taken towards this target could also help to implement commitments related to the species focussed multilateral agreements such as CITES (2012).

World Heritage Convention

A number of bontebok occur on the Robben Island World Heritage Site and the Cape Floral Region Protected Areas World Heritage Site which includes all formally protected areas where bontebok occur except for the West Coast National Park.

Convention on international Trade of Endangered Species of Wild Fauna and Flora (CITES)

The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) aims to ensure that international trade in CITES listed species is sustainable and not detrimental to the survival of the species in the wild. South Africa ratified to CITES in 1975 and is one of the 183 current signatories to the Convention. CITES works by subjecting international trade in specimens of selected species to certain controls. All import, export, re-export and introduction from the sea of species covered by the Convention has to be authorized through a licensing system. Each Party to the Convention must designate one or more

Management Authorities in charge of administering that licensing system and one or more Scientific Authorities to advise them on the effects of trade on the status of the species.

The Conference of the Parties (CoP), which is the supreme decision-making body of the Convention and comprises all its Parties, has agreed in Resolution Conf. 9.24 (Rev. CoP17) on a set of biological and trade criteria to help determine whether a species should be included in Appendices I or II. At each regular meeting of the CoP, Parties submit proposals based on those criteria to amend these two Appendices. Those amendment proposals are discussed and then submitted to a vote. The Convention also allows for amendments by a postal procedure between meetings of the CoP (Article XV, paragraph 2, of the Convention), but this procedure is rarely used. CITES listed species are categorized in three Appendices (Appendix I, II and III) according to the extent to which they are threatened. Bontebok is currently listed in Appendix II as explained below.

Appendix II

Appendix II includes species not necessarily threatened with extinction, but in which trade must be controlled in order to avoid utilization incompatible with their survival. An export permit or re-export certificate issued by the Management Authority of the State of export or re-export is required. An export permit may be issued only if the specimen was legally obtained and if the export will not be detrimental to the survival of the species. A re-export certificate may be issued only if the specimen was imported in accordance with the Convention. In the case of a live animal or plant, it must be prepared and shipped to minimize any risk of injury, damage to health or cruel treatment. No import permit is needed unless required by national law. In the case of specimens introduced from the sea, a certificate has to be issued by the Management Authority of the State into which the specimens are being brought, for species listed in Appendix I or II.

International Union of Conservation of Nature (IUCN)

Established in 1964, the International Union for Conservation of Nature's Red List of Threatened Species has evolved to become the world's most comprehensive information source on the global conservation status of animal, fungi and plant species. The IUCN Red List is a critical indicator of the health of the world's biodiversity. Far more than a list of species and their status, it is a powerful tool to inform and catalyze action for biodiversity conservation and policy change, critical to protecting the natural resources we need to survive. It provides information about range, population size, habitat and ecology, use and/or trade, threats, and conservation actions that will help inform necessary conservation decisions.

According to Radloff *et al*, the IUCN Red List status for bontebok was changed to "Vulnerable" (VU B2ab (ii) +D1) as conservation action has seen the numbers of this subspecies increase within the NDR and ENDR within the Western Cape. The IUCN Red List is set upon precise criteria to evaluate the extinction risk of thousands of species and subspecies. These criteria are relevant to all species and all regions of the world. The summary of the IUCN Criteria used for the species assessment is attached to this BMP as Appendix F for ease of reference.

2.6.2 National legislation

National Environmental Management Biodiversity Act 10 of 2004 (NEM: BA)

The NEM: BA gives effect to the constitutional commitment to take reasonable legislative measures that promote conservation by providing for the management and conservation of biological diversity and the sustainable use of indigenous biological resources.

Section 60 (1) of NEMBA makes provision for the establishment of the Scientific Authority for the purpose of assisting in regulating and restricting the trade in specimens of listed threatened or protected species, and CITES-listed species. The functions of the Scientific Authority include making non-detriment findings on the impact of actions relating to the international trade in specimens of listed threatened or protected species. "Non-detriment findings" means the determination of the non-detrimental impact of an action on the survival of a species.

National Environmental Management: Protected Areas Act, 57 of 2003 (NEM: PAA)

NEM: PAA provides for the protection and conservation of ecologically viable areas representative of South Africa's biodiversity and natural landscapes and seascapes in protected areas. Protected areas in South Africa

offer a viable tool for habitat protection and the protection and maintenance of ecologically viable numbers of the bontebok and their associated species and habitats.

Threatened or Protected Species Regulations, 2007 (ToPS)

The Threatened or Protected Species (ToPS) Regulations promulgated in terms of NEM: BA came into force in February 2008. The regulations provide for the protection of species that are threatened or in need of protection to ensure their survival in the wild and give effect to the Republic's obligations. Bontebok are currently listed as "Protected". At the time of writing (October 2016). The ToPS Regulations, 2007, are going through a comprehensive process of review and amendment

Convention on International Trade in Endangered Species of Wild Fauna and Flora Regulations, 2010 (CITES Regulations)

On 05 March 2010, the Minister of Environmental Affairs published CITES Regulations, 2010 in the *Government Gazette* No. 33002, for implementation. These regulations were published in terms of section 97 of the NEMBA, and give effect to the Republic of South Africa's obligations in terms of a ratified international agreement as far as it relates to international trade in endangered species.

Regulation 6(3)(c) of the CITES Regulations, 2010 states that an export permit may only be granted if the following condition (amongst others) is met:

"(c) In the case of a specimen of a species listed in Appendix I or II, the Scientific Authority has made a non-detriment finding and advised the Management Authority accordingly".

2.6.3 Other relevant South African legislation

Apart from the National Environmental Management Act, 107 of 1998 (NEMA) and its related Acts and Regulations, the nine provincial conservation ordinances / acts are the major regulatory instruments for the regulation of wild animal species in South Africa.

Transvaal Nature Conservation Ordinance, 12 of 1983 (implemented in Gauteng; Limpopo; North West and Mpumalanga Provinces) and augmented by:

- Gauteng Nature Conservation Ordinance, 1983 – Gauteng Nature Conservation Act, 2014;
- Limpopo Nature Conservation Ordinance, 1983 – Limpopo Environmental Management Act, 2003; Gazankulu Nature Conservation Act, 5 of 1975, Venda Nature Conservation Act, 10 of 1973;
- Mpumalanga Ordinance, 1983 - Mpumalanga Nature Conservation Act, 10 of 1998;
- North West Nature Conservation Ordinance, 1983; Bophuthatswana Nature Conservation Act, 1973; Lebowa Nature Conservation Act, 1973, and tribal rule.

Cape Province Nature Conservation Ordinance, 19 of 1974 (implemented in the Western Cape; Eastern Cape including Ciskei and Transkei; Northern Cape and North West Provinces) and augmented by:

- Western Cape Nature Conservation Ordinance, 19 of 1974 – Western Cape Biodiversity Bill *in prep.*
- Northern Cape Nature Conservation Act, 9 of 2009.
- Eastern Cape Nature Conservation Ordinance, 19 of 1974; Ciskei Nature Conservation Act, 10 of 1987; Transkei Decree, 9 of 1992.

Natal Nature Conservation Ordinance, 15 of 1974 (implemented in KwaZulu-Natal Province, including KwaZulu)

- KwaZulu Nature Conservation Act, 29 of 1992 – KwaZulu-Natal Nature Conservation Management Act, 9 of 1997; KwaZulu Nature Conservation Act, 8 of 1975.

Free State Nature Conservation Ordinance, 1969 (implemented in the Free State Province, including QwaQwa) and augmented by:

- Free State Nature Conservation Ordinance, 8 of 1969; QwaQwa Nature Conservation 5 of 1976.

Supporting decision making instruments include National Norms and Standards and Provincial Conservation and Regulatory Policies.

Other Acts such as the Animals Protection Act, 71 of 1962 as amended, which regulates animal welfare in South Africa is also applicable to wildlife.

The Game Theft Act, 105 of 1991; the Fencing Act, 31 of 1963; the Animal Health Act, 7 of 2002; Animals Diseases Act, 35 of 1984; Medicines and Related Substances Control Act, 101 of 1965; and the Animal Matters Amendment Act, 42 of 1993, may also be relevant to bontebok conservation as it plays a significant role in veterinary care of animals, as well as their translocation.

3) PLANNING FRAMEWORK

3.1 The planning context

The South African National Parks and CapeNature initiated the development of this BMP-S for bontebok and co-hosted a workshop whereby a panel of experts and stakeholders jointly drew up the key aspects of this BMP-S. A Background Document consisting of all current information on bontebok was distributed and discussed at the workshop. Workshop participants developed a desired state for bontebok and also identified and prioritised the key threats to bontebok. In order to mitigate or prevent these threats they formulated a set of objectives following guidelines depicted in Figure 3.1. These objectives are written in such a way, that an explicit outcome is stated and it is clear that action is needed to achieve this outcome. Actions are monitored and evaluated and feedback provided in order for strategic adaptive management to be adopted within this BMP.

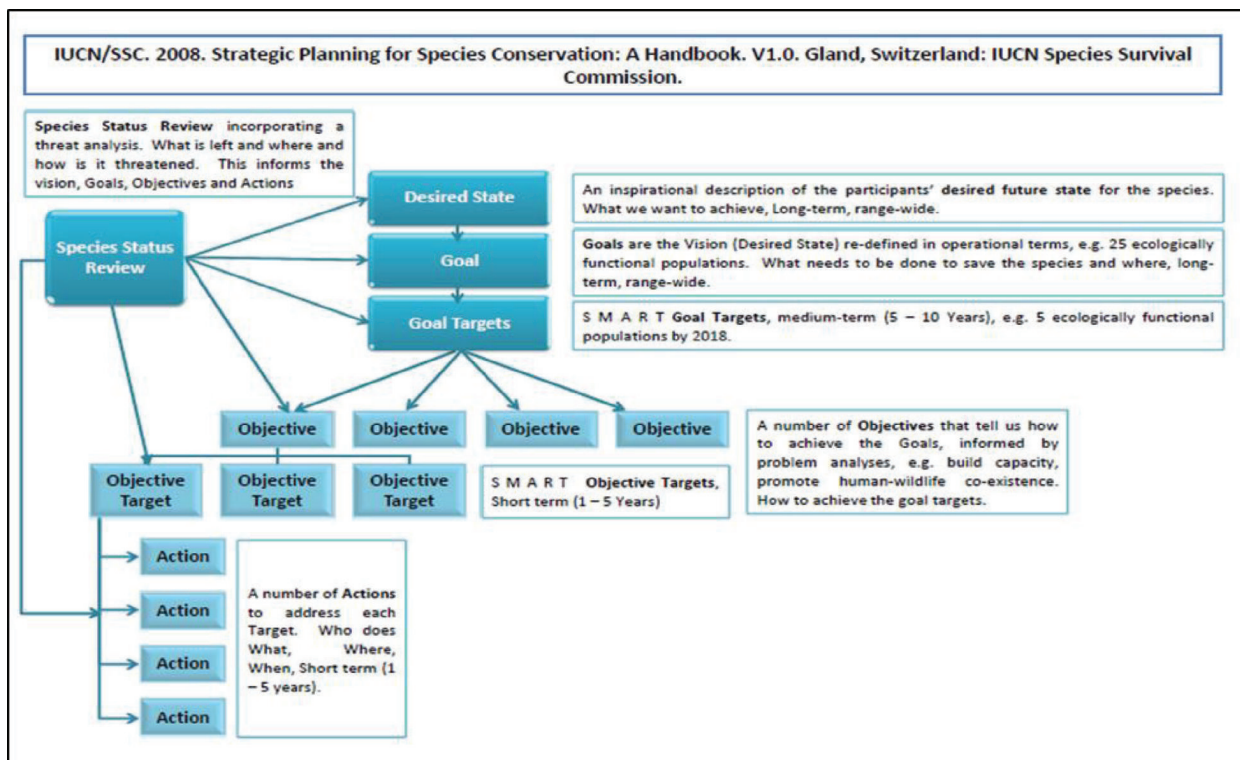


Figure 3.1: IUCN Species Survival Commission schematic for species conservation planning.

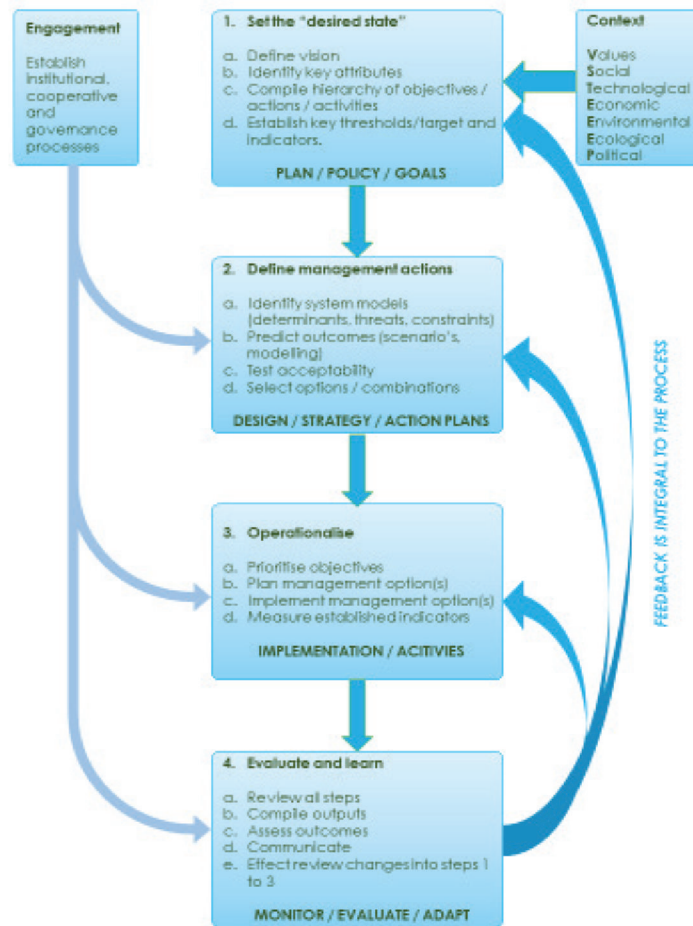


Figure 3.2: Strategic Adaptive Management Framework adapted from Kingsford, R.T., Biggs, H.C. and Pollard, S.R. 2010, and Strategic Adaptive Management in freshwater protected areas and their rivers. *Biological Conservation* 144, 1194-1203. doi:10.1016/j.biocon.2010.09.022.

3.2 Key role players

Key role players and stakeholders in the management of bontebok are the following (Table 3.2).

- Government departments and agencies (at a national, provincial and local level) that are mandated, in terms of legislation, to protect this species and to implement the actions identified in this plan in order to ensure the survival of this species in the wild.
- Other government departments involved in regulating activities that may positively / negatively impact the species.
- Private land owners with herds of bontebok on their land either for conservation or game ranching.
- Tertiary institutions involved with research relevant to the species.
- Non-governmental organisations, at both a national and international level, providing funding for research, students and projects.
- The tourism industry particularly eco-tourism operators.

Table 3.2 Organisations that are involved in developing and implementing various aspects of the bontebok BMP-S.

National Government	Department of Agriculture, Forestry and Fisheries
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	Department of Environmental Affairs (Biodiversity and Conservation, Legal, etc.) South African National Biodiversity Institute South African National Parks National Zoological Gardens of South Africa
Provincial Government	CapeNature Northern Cape Province: Department of Environment and Nature Conservation Eastern Cape Province: Department of Economic Development, Environmental Affairs and Tourism Free State Province: Department Economic, Small Business Development, Tourism and Environmental Affairs Limpopo Province: Department of Economic Development, Environment and Tourism Ezemvelo KZN Wildlife Gauteng Province: Department of Agriculture and Rural Development Eastern Cape Parks and Tourism Agency
Academic Institutions	University of the Free State University of Cape Town: Animal Demography Unit University of Western Cape Stellenbosch University
Non-Government Organisations	WWF WRSA PHASA SAHGCA
Other	

3.3 Stakeholder engagement

An email invitation was sent on the 21 October 2013 to a list of people known to be experts in matters relating to bontebok antelope and known representatives of organisations managing bontebok, requesting their participation in a Workshop to draft a BMP-S. They were asked to recommend additional stakeholders that they thought could contribute to the compilation of the Biodiversity Management Plan.

The Stakeholder Workshop was held on 28 November 2013 (Appendix 1). The workshop included presentations on the current state of knowledge for bontebok. The group as a collective developed the Desired State and identified the key threats to long term survival of bontebok. Break-away groups led by an expert in that particular field, then developed Objectives and Action Plans for each threat. The proceedings of the Workshop were used to compile the draft Biodiversity Management Plan for bontebok. This draft was compiled by representatives of SANParks and CapeNature.

The draft Biodiversity Management Plan that contained the threats and actions were sent to the stakeholders for comments and contributions. These were then incorporated into the document, with all the supporting background information. The draft Bontebok Biodiversity Management Plan will be submitted to the Department of Environmental Affairs (DEA) who will take it through the formal approval process.

3.4 Relevant agreements

There is currently no formal inter-agency agreement as far as the management of bontebok is concerned. Apart from the three stakeholder and internal workshops held, a meeting held between the Eastern Cape Parks

and Tourism Agency, SANParks and CapeNature in January 2016 in Stellenbosch will form the basis of future inter-agency cooperative agreements, formal Memoranda of Understanding (MOU) and/or protocols to be developed.

3.5 Identification of lead and implementing agencies

A final BMP-S workshop with conservation agencies and other stakeholders was held on 22 November 2016 (Agenda and Attendance Registers are attached as Appendix D). During this workshop all stakeholders for the BMP-s were identified and confirmed, and the relationships between stakeholders were workshopped by small working groups as an introduction to the rest of the proceedings. The outputs of this (Venn diagrams representing different stakeholders and their respective relationships) are attached as Appendix E. This exercise informed further discussion and final agreement on who the respective lead and responsible agencies are, as well as the collaborators. Both the Western Cape Department of Local Government, Environmental Affairs and Development Planning (DEADP) through CapeNature as a suitable organ of state responsible for the implementation of the plan in the Western Cape and the Eastern Cape Department of Economic Development, Environmental Affairs and Tourism (DEDEAT) as a suitable organ of state responsible for the implementation of the plan, in the Eastern Cape accepted the responsibility to implement the Bontebok BMP-S within their jurisdiction. The workshop further identified additional lead and implementing agencies, and collaborators for the respective actions under each Objective Target. The workshop and all stakeholders present concluded and reached consensus on all identified actions under each objective target.

It should be noted that the NC DENC could not attend the workshop but provided extensive comments on the document. Similarly, the EC DEDEAT and FS DESTEA could not attend either, but have also supplied comments on earlier versions of the BMP-S.

3.6 Expert Verification of Quality of Content and Context

The stakeholders who were involved in the compilation of this Biodiversity Management Plan include the leading experts on this species and related issues. They have provided input and commented on this plan throughout the compilation process.

4) BIODIVERSITY MANAGEMENT PLAN

4.1 Lead and implementing agencies

Lead agencies:	Western Cape Department of Local Government, Environmental Affairs and Development Planning (DEADP) through CapeNature by delegation of powers & DEDEAT for Eastern Cape	
Implementing Agencies:	DEA:	Regulation, coordination of implementation, monitoring, evaluation and annual reporting.
	CapeNature:	Regulation, research collaboration, population management, monitoring and reporting.
	SANParks:	Population management, monitoring, research collaboration and reporting.
	ECPTA:	Population management, monitoring, research collaboration and reporting.
	EC DEDEAT:	Regulation, monitoring and reporting.
	NC DENC:	Regulation, population management, monitoring, research collaboration and reporting.
	FS DESTEA:	Population management, monitoring, research collaboration and reporting.
	NZG:	Research, monitoring and reporting.
	SANBI:	Monitoring, reporting and research facilitation.

4.2 Identified threats and challenges

4.2.1 THREAT: Habitat alteration and fragmentation

Fragmented populations, primarily on sub-optimal habitat (within NDR and ENDR), are currently managed as sources for distribution of bontebok to properties outside the natural range for commercial gain, while comparatively little effort is being afforded towards habitat rehabilitation and restoration to secure the future of bontebok within its NDR. While some subpopulations have exhibited positive growth rates, offtakes and translocations from within the natural range has suppressed overall population growth. Similarly, the lack of available habitat within the natural range has inhibited population expansion and an increase in area of occupancy.

4.2.2 THREAT: Inbreeding

In the 1930's the 17 bontebok that survived loss of habitat due to agriculture, livestock farming and overhunting were introduced into the original Bontebok National Park. This population increased and in 1960, 61 animals were successfully translocated to the then newly establish Bontebok National Park (Barnard and van der Walt 1961). According to van Wyk *et al.* (2013) the restricted number of original breeding animals (17), in combination with the population's isolation may have contributed to low levels of genetic diversity.

Measures of genetic diversity in the reference bontebok were found to be lower than that of reference blesbok populations. The lower level of molecular diversity observed within the reference bontebok is however expected given its demographic history. The bontebok does not have the buffering effect of a large genetic reservoir and inbreeding may thus be detrimental to the bontebok population (Van Wyk *et al.* 2013). Slow recovery and growth of the bontebok populations may be attributed to environmental factors, unstable sex ratios and/or low reproductive success. In the long-term, low genetic variation in combination with population isolation may result in an increase in the risk of extinction (Van Wyk *et al.* 2013).

4.2.3 THREAT: Hybridisation

Hybridisation between the bontebok and blesbok is of specific concern to the conservation of bontebok (Van Wyk *et al.* 2013). Hybridisation between the two subspecies has occurred due to human-mediated mixing. Blesbok occur widely throughout South Africa outside of the Western Cape. There is a concern that private landowners may be translocating bontebok to properties where hybrids are already present or to properties that neighbour blesbok populations. However, what is not known is the full extent to which hybridisation has

occurred. Negative consequences associated with hybridisation include reduction of fitness, alteration in the genetic structure of populations and the interference of locally co-adapted gene complexes (Allendorf et al. 2001). Van Wyk *et al* (2013) have called for research on bontebok and blesbok hybridisation to be expanded to include all regions in South Africa where potentially bontebok populations may be under threat.

4.2.4 THREAT: Unregulated hunting and trade

A more recent threat is the increased pressure of hunting and harvest regimes for bontebok which could negatively impact this species by off-takes in areas outside of the NDR and thus a loss to conservation if conservation principles (non-selective breeding, hybridisation) are not applied. Given the limited genetic diversity of bontebok a well-managed harvest regime needs to be implemented to prevent the loss of genetic diversity *via* biased selection pressures (for coat colour, pattern and horn sizes). The killing of individuals with higher levels of genetic diversity can also exacerbate the negative effects of inbreeding.

4.2.5 CHALLENGE: Implementation of effective Meta-population management

A meta-population plan is required to sustain bontebok genetic purity and diversity. Within the natural range, there are many properties containing small subpopulations which cannot increase in size because they are limited by space. There is also a space limitation due to land use for extensive crop production. Thus, although there is still scope for the core population to increase, protected areas and private conservation areas must significantly expand to create larger areas of natural habitat for the population and these should be connected to a wider meta-population that includes the extended natural range to become a resilient population. Bontebok are currently exported out of the Western Cape to areas outside of their NDR where they are hunted and then no longer contribute to the meta-population management needs to address this sink effect and ensure bontebok from outside the NDR contribute to the survival of this species.

4.2.6 CHALLENGE: To provide incentives for private land owners to maintain viable sub-populations of bontebok in its natural distribution range

Hunting, trading and stock accessibility, have been identified as potential bontebok derived incentives. Conservation accreditation schemes, meta-population participation and the provision of conservation management guidelines and support have also been identified as potential incentives, whereas strict policy and legislative requirements have been noted as disincentives. The opportunity exists for fragmented natural areas to be linked *via* corridors to larger natural areas and conserve more of the threatened Renosterveld vegetation. Although the population size of bontebok has increased, it has remained relatively low compared with other ruminant species (Broders et al. 1999). By increasing the status and value of bontebok through land restoration subsidies, private land owners may be willing to stock bontebok on their farms in the NDR. Intangible incentives, such as recognition and identification of bontebok conservation champions can help build trust between conservation agencies and private land owners through active relationship management.

4.2.7 CHALLENGE: To consistently and uniformly implement legislation, policies and IUCN guidelines

Provinces have differing conservation legislations, policies, priorities and objectives and are funded *via* provincial treasuries aligned with the provincial priorities, resulting in variation in the allocation of capacity and resources for nature conservation. Collectively, the provinces have incorporated approximately 22 sets of nature conservation legislation, including decrees and tribal rules effected in previous homeland states. The concurrent competence issue (environment and nature conservation) between the national and provincial departments creates confusion for the public and potentially obscures specific mandates. The NEM: BA and its subsidiary legislation is implemented by the DEA as well as provinces and incorporates various mandatory obligations in terms of international conventions and agreements. The magnitude of legislation, processes and mandates may appear poorly aligned and inconsistently implemented, resulting in over or under regulation of specific activities towards different objectives ((PMG). 2014; Birss 2014; Goitom 2013). If not corrected this could have a negative effect on bontebok conservation.

4.2.8 CHALLENGE: To communicate and collaborate effectively among stakeholders

An increase in the number of sub-populations of bontebok on private land, an increased interest in utilisation of the species and the increased interest by NGO governing bodies within the wildlife industry, resulted in

increased challenges for reconciling the objectives of conservation agencies with the objectives of wildlife ranchers, hunters, animal activists, animal welfare organisations and academia.

4.2.9 CHALLENGE: To overcome management and capacity constraints

Conservation management agencies are constrained by limited and decreasing funding for the implementation of conservation action plans, compliance and enforcement. Inadequate or inappropriate equipment, capacity and expertise within the formal conservation agency sector as well as in the private ranching sector encumbers effective management of some sub-populations. The deficiency of site-level management plans and an overall management strategy further disables effective and efficient meta-population-oriented management of bontebok sub-populations.

4.2.10 CHALLENGE: To create awareness regarding low genetic variation and hybridisation

A key management challenge is the low genetic variation within the NDR population which could potentially lead to a genetic bottleneck. The risk of hybridisation when blesbok are introduced into the bontebok NDR and ENDR populations due to the relaxation of laws prohibiting blesbok in the Western Cape and the introduction of bontebok to other provinces in South Africa, is a major threat to the genetic integrity of bontebok. Hybridisation between the bontebok and blesbok is of specific concern to the conservation of bontebok (Van Wyk et al. 2013). Hybridisation between the two has occurred due to human-mediated mixing of the separate subspecies. However, what is not known is the full extent to which hybridisation occurs. Negative consequences associated with hybridisation include reduced fitness, alteration in the genetic structure of populations and the interference of locally co-adapted gene complexes (Allendorf et al. 2001). Anthropogenic hybridisation may occur due to fostered changes in the abundance and distribution of the species, the removal of some barriers that will cause isolated or restricted populations to expand, or by the uncontrolled diffusion with domestic species.

4.2.11 CHALLENGE: To integrate conservation planning

Although there has been numerous studies on bontebok the research has been found to be outdated and new research is required. The existing network of protected areas, protected area expansion strategies and the establishment of connectivity corridors, do not adequately incorporate bontebok meta-population conservation objectives. The long term conservation of bontebok requires connectivity of suitable habitat, access to water and optimal forage across landscapes which needs to be incorporated into integrated conservation plans (in other words, identifying spatially explicit priorities and actions for the conservation of bontebok). Anthropogenic relocation to other areas to mimic connectivity would undermine the value of bontebok as a flagship species for renosterveld conservation.

5) ACTION PLAN AND MONITORING FRAMEWORK

The bontebok BMP-S planning process is aligned to the framework provided by the IUCN SSC for species conservation planning. It has guided the stakeholder engagement and planning workshops in defining the objectives and actions for this BMP-S. The various workshop outputs have guided the compilation of the Action Plan and Monitoring Framework to enable effective reporting as shown in Figure 5.

Figure 5: Action Plan and Monitoring Framework derived from IUCN Species Survival Commission schematic for species conservation planning methodology applied for this BMP-S.

5.1 OBJECTIVE 1: TO CONSERVE THE GENETIC INTEGRITY AND DIVERSITY OF BONTEBOK		
Objective Target 1.1 Conserve genetically diverse meta-population		
5.1.1.1 ACTION: DEVELOP A SOUND META-POPULATION MANAGEMENT GUIDELINE.		
Lead agencies:	CN	
Collaborators:	SANBI: NZG, DEA, SANPARKS, SANBI, DAFF, ECPTA, EC DEDEAT, NC DENC, WRSA, SAHGCA, WPA, Private sector, Higher Education Institutions	
Essential activities:	<ol style="list-style-type: none"> 1) Compile bontebok meta-population management guidelines with clear objectives and principles for contributing sub-populations, including criteria for identifying source, sink and reinforcement sub-populations and meta-population management methodology 2) Evaluate the status of all sub-populations and make recommendations for the management and contribution toward the objectives of the bontebok meta-population. 3) Implement meta-population management 4) Include guidelines into site specific management plans for implementation. 	
Expected Outcome in 5 yrs.:	1) Meta-population management implemented – increased genetic resilience/diversity	
Monitoring and Evaluation:	1) Population demographics & genetics	
Funding / Resources	Timeframe	Measurable Indicators / Outputs
Agency operational budget	Within two years of BMP being gazetted	Meta-population management guideline; Assessment of sub-populations
Challenges: CapeNature capacity constraints		

5.1.1.2 ACTION: INVESTIGATE THE GENETIC DIVERSITY OF THE BONTEBOK AND DEVELOP MODELS AND NATIONAL PROTOCOLS TO MAINTAIN GENETIC DIVERSITY AND INTEGRITY IN BONTEBOK		
Lead agencies:	CN	
Implementing agencies:	SANParks, DEA, NZG, ECPTA, EC DEDEAT, FS DESTEA, NC DENC, NW DREAD, DAFF	
Collaborators:	UFS, UWC, Cardiff University, Tennessee University, WRSA, SAHGCA, Private sector, SUN, UCT	
Essential activities:	1) Develop national protocol for genetic sampling, forensic process and testing	

	2) Collect samples (currently opportunistic during translocations only)	
	3) Develop genetic management model in collaboration with SANBI and UCT SWK	
	4) Analyse data from maximum number of sub-populations	
Expected Outcome in 5 yrs.:	1) Standardised genetic testing. 2) Genetic diversity of subpopulations known to inform adaptive management of meta-population strategy implementation.	
Monitoring and Evaluation:	2) Increased sampling efficiency and efficacy; 3) Reduced risks associated with invasive sampling techniques; 4) Reliable, repeatable genetic test results achieved; 5) Decreased risk of loss of allelic diversity; 6) Improved sub-population performance.	
Funding / Resources	Timeframe	Measurable Indicators / Outputs
Agency operational budget	Immediate	Genetic sampling protocol standardised and implemented consistently in South Africa; Centralised depository
Challenges:		

Objective Target 1.2 Safeguard bontebok against hybridisation

5.1.2.1 ACTION: MANAGE THE RISK OF HYBRIDISATION OF BONTEBOK WITH BLESBOK.		
Lead agencies:	SANParks, CN	
Implementing agencies:	ECPTA, EC DEDEAT, FS DESTEA, NC DENC, NW DREAD	
Collaborators:	WRSA, SAHGCA, Private sector	
Essential activities:	1) Develop and maintain a national distribution register of hybridisation events between bontebok and blesbok 2) Assess, quantify and prioritise bontebok sub-populations in the natural distribution range at risk of hybridisation 3) Co-develop with private landowners an exit policy for the removal of blesbok / hybrids within the NDR.	
Expected Outcome in 5 yrs.:	1) Decrease instances of hybridisation	
Monitoring and Evaluation:	1) Regular genetic testing and reporting of any hybrids and actions taken to control these. 2) Decrease in numbers of blesbok and hybrids in NDR in Western Cape based on game database information.	
Funding / Resources	Timeframe	Measurable Indicators / Outputs
Agency operational budget	Immediate	Hybrid detection and hybrid risk assessment protocols
4) Challenges: Landowner compliance: Ensuring that blesbok and hybrids are prevented from interacting with bontebok meta-population by ensuring that they are adequately enclosed or euthanized.		

5.1.2.2 ACTION: DEVELOP A LIST OF PRIORITY SITES FOR REINFORCEMENT AND REINTRODUCTION.		
Lead agencies:	CN	
Implementing agencies:	SANParks	

Collaborators:	SANBI	
Essential activities:	1) Develop assessment guidelines for potential reinforcement and reintroduction sites 2) Develop prioritisation guideline for potential bontebok reinforcement and reintroduction sites 3) Develop prioritised list of sites and Conduct site assessments.	
Expected Outcome in 5 yrs.:	1) Increased distribution of viable bontebok sub-populations in NDR	
Monitoring and Evaluation:	1) Site assessment reports, monitoring of populations and veld condition & carrying capacity	
Funding / Resources	Timeframe	Measurable Indicators / Outputs
Agency operational budget	Within two years of BMP being gazetted	Priority sites identified; Site assessment, translocation and prioritisation guideline
Challenges: Data accuracy – non verified vegetation data		

Objective Target 1.3 Implement a meta-population management framework

5.1.3.2 ACTION: MAINTAIN A CENTRALISED NATIONAL BONTEBOK GENETICS DATABASE.		
Lead agencies:	NZG,	
Implementing agencies:	DEA, SANBI: NZG, SANParks, CN, ECPTA, EC DEDEAT, FS DESTEA, NC DENC, NW DREAD	
Collaborators:	SANBI, WRSA, WPA, SAHGCA, Private sector	
Essential activities:	1) Collate and update bontebok DNA profiles in centralised database.	
Expected Outcome in 5 yrs.:	1) National centralised database established and linked to distribution database	
Monitoring and Evaluation:	1) Established national database which is updated ad hoc and reported on annually.	
Funding / Resources	Timeframe	Measurable Indicators / Outputs
Agency operational budget	Immediate	Bontebok DNA profiles
Challenges:		
5.1.3.1 ACTION: MAINTAIN A CENTRALISED NATIONAL BONTEBOK POPULATION DATABASE.		
Lead agencies:	SANBI, CN, SANParks	
Implementing agencies:	ECPTA, EC DEDEAT, FS DESTEA, NC DENC, NW DREAD	
Collaborators:	WRSA, SAHGCA, Private sector	
Essential activities:	1) Collate and update bontebok distribution, population source, population dynamics, introductions and off-take data annually.	
Expected Outcome in 5 yrs.:	1) National centralised distribution database established	

Monitoring and Evaluation: 1) Established national database which is updated ad hoc and reported on annually.		
Funding / Resources	Timeframe	Measurable Indicators / Outputs
Agency operational budget	Immediate	Spatial bontebok distribution databases
Challenges: Access to information, NC DENC has capacity challenges		

Objective Target 1.4 Long term monitoring of bontebok sub-populations

5.1.4.1 ACTION: IMPLEMENT STANDARDISED BONTEBOK SURVEY AND MONITORING PROTOCOLS FOR PROTECTED AREAS TO INFORM ADAPTIVE MANAGEMENT.		
Lead agencies:	CN, SANParks	
Implementing agencies:	SANParks, CN, ECPTA, EC DEDEAT, NC DENC	
Collaborators:	SANBI, WRSA, SAHGCA, Private sector	
Essential activities:	<ol style="list-style-type: none"> 1) Develop standardised data collection and population monitoring protocols for bontebok sub-populations on protected areas 2) Develop standardised population monitoring protocols for bontebok sub-populations on private land 3) Conduct regular standardised sub-population assessments according to guidelines, (precision based, game census) 	
Expected Outcome in 5 yrs.:	1) Accurate population trend data informing strategic adaptive management.	
Monitoring and Evaluation:	1) Annual trend data obtained from surveys and monitoring	
Funding / Resources	Timeframe	Measurable Indicators / Outputs
Agency operational budget / Additional funding for aerial census required.	Immediate	Precise game censuses, standardised monitoring protocols
Challenges: Accurate population trend data, capacity and resources. Sourcing and securing funding for implementation of census techniques (aerial).		

5.1.4.2 ACTION: COORDINATE ANNUAL BONTEBOK SUB-POPULATION STATUS REPORTS.		
Lead agencies:	SANBI,	
Implementing agencies:	CN, SANParks, ECPTA, EC DEDEAT, FS DESTEA, NC DENC, NW DREAD	
Collaborators:		
Essential activities:	<ol style="list-style-type: none"> 1) Develop and implement standardised annual reporting formats for bontebok sub-populations 2) Collate sub-population status reports and analyse overall meta-population performance 	
Expected Outcome in 5 yrs.:	1) Quality bontebok sub-population data	
Monitoring and Evaluation:	1) Annual Population status reports available	
Funding / Resources	Timeframe	Measurable Indicators / Outputs

Agency operational budget	Immediate	Standardised annual reporting and status reports
Challenges: Flow and availability of data for collating report		

5.1.4.3 ACTION: MONITOR POPULATION PERFORMANCE AND HABITAT CONDITION FOR BONTEBOK ON PRIVATE LAND.		
Lead agencies:	CN	
Implementing agencies:	SANParks, ECPTA, EC DEDEAT, FS DESTEA, NC DENC, NW DREAD	
Collaborators:	SANBI, WPA, SAHGCA, Private Sector	
Essential activities:	<ol style="list-style-type: none"> 1) Identify viable populations contributing to conservation of bontebok. 2) Regulatory agencies to develop and implement standardised habitat and population assessments for bontebok on private land 3) Conduct assessment of habitat quality, habitat area availability and intra-specific competition for bontebok sub-populations on private land 	
Expected Outcome in 5 yrs.:	1) Viable populations established and maintained	
Monitoring and Evaluation:	1) Population monitoring report produced every five years	
Funding / Resources	Timeframe	Measurable Indicators / Outputs
Agency operational budget/Contributions from Private Sector	Within three years of the BMP-s being gazetted	Standardised habitat and population assessments for introductions
Challenges: Capacity for conducting assessments. Resources for data collation and follow-up inspection results and report production must be sourced.		

5.2 OBJECTIVE 2: TO PREVENT FURTHER HABITAT LOSS AND HABITAT DEGRADATION, AND ESTABLISH AND MAINTAIN HISTORIC HABITAT CONNECTIVITY

Objective Target 2.1 Restore habitat and connectivity

5.2.1.1 ACTION: IMPLEMENT HABITAT EXPANSION THROUGH STEWARDSHIP, CUSTODIANSHIP AND CONNECTIVITY CORRIDORS IN THE NATURAL DISTRIBUTION RANGE OF BONTEBOK.

Lead agencies:	CN, SANParks	
Implementing agencies:	DAFF, conservation agencies	
Collaborators:	DEA&DP, local municipalities Stewardship agencies, , private landowners, WWF/BirdLife SA ,NGOs	
Essential activities:	<ol style="list-style-type: none"> 1) Identify priority bontebok habitat sites at provincial and national level to inform expansion and custodianship initiatives 2) Integrate bontebok habitat requirements into conservation planning processes 3) Prioritise and implement bontebok stewardship and custodianship agreements at priority sites 4) Acquire suitable land for bontebok habitat expansion 	
Expected Outcome in 5 yrs.:	1) Increased distribution of bontebok in the natural distribution range	
Monitoring and Evaluation:	<ol style="list-style-type: none"> 1) Priority habitat map 2) PA expansion 	
Funding / Resources	Timeframe	Measurable Indicators / Outputs
Agency operational budget. Funding sourced for land acquisition.	Immediate	Fine-scale habitat map of possible stewardship/custodian sites Prioritised expansion/custodian sites Habitat suitability matrix
Challenges: Funding to purchase available land, scarcity of suitable land, landowner willingness. Stewardship selection criteria focused on vegetation, should include priority fauna		

5.2.1.2 ACTION: DEVELOP GUIDELINES AND IMPLEMENT HABITAT REHABILITATION IN THE NATURAL DISTRIBUTION RANGE OF BONTEBOK		
Lead agencies:	CN	
Implementing agencies:	SANParks, DAFF, DEA&DP, local municipalities	
Collaborators:	Stewardship agencies, Higher Education Institutions, DEA-NRM, SANBI	
Essential activities:	<ol style="list-style-type: none"> 1) Implement Alien Vegetation Management on priority habitats for bontebok in the natural distribution range 2) Develop guidelines for private landowners for habitat restoration for bontebok 3) Engage with key partners (BGCMA, FPAs, EPWP) for implementation 	
Expected Outcome in 5 yrs.:	<ol style="list-style-type: none"> 1) Increased availability of viable habitat 2) Bontebok recognised as flagship species for renosterveld conservation 3) Decreased density of alien vegetation 	
Monitoring and Evaluation:	1) Rehabilitation guidelines developed, Alien Vegetation Management projects implemented	
Funding / Resources	Timeframe	Measurable Indicators / Outputs
Agency operational budget and sourcing of funding from NGOs	Within two years of gazetting	Rehabilitation guidelines. AVM hectares cleared
Challenges: Cost of rehabilitation programmes, rezoning of land for conservation, landowner willingness		

5.3 OBJECTIVE 3: TO ESTABLISH AND MAINTAIN EFFECTIVE COMMUNICATION AND AWARENESS BETWEEN AND AMONG STAKEHOLDERS

Objective Target 3.1 Establish and maintain partnerships for bontebok conservation

5.3.1.1 ACTION: FORMALISE INTER-AGENCY COLLABORATION TO COORDINATE AND REVIEW THE IMPLEMENTATION OF THE BONTEBOK BMP-S.		
Lead agencies:	CN	
Implementing agencies:	SANPARKS, ECPTA, EC DEDEAT, FS DESTEA, NC DENC, NW DREAD, DEA	
Collaborators:		
Essential activities:	<ol style="list-style-type: none"> 1) Establish a Steering Committee for the implementation and review of the bontebok BMP-S 2) Develop Steering Committee terms of reference and reporting framework, ToR to address DEA involvement. 3) Develop and implement an inter-agency capacity development and exchange strategy 4) Draft an inter-agency MOU for the exchange, and or donation of bontebok to attain the objectives of the bontebok BMP-S. 5) National communication with all role players (to improve collaboration and coordination between stakeholders) 	
Expected Outcome in 5 yrs.:	<ol style="list-style-type: none"> 1) Established and formalised Steering Committee. 2) Improved inter-agency collaboration and coordination. 	
Monitoring and Evaluation:	1) Minutes of Steering Committee meetings.	
Funding / Resources	Timeframe	Measurable Indicators / Outputs
Agency operational budget	Within year one.	Formalised MoU ToR of Steering Committee an inter-agency capacity development and exchange strategy
Challenges: Formalizing inter-agency agreements		

5.3.1.2 ACTION: ENGAGE AND COLLABORATE WITH STAKEHOLDERS FOR BONTEBOK CONSERVATION		
Lead agencies:	CN, SANPARKS	
Implementing agencies:	ECPTA, EC DEDEAT, FS DESTEA, NC DENC, NW DREAD, DEA, DAFF	
Collaborators:	WRSA, SAHGCA, Private sector, NZG, Higher Education Institutions	
Essential activities:	<ol style="list-style-type: none"> 1) Communicate bontebok BMP-S objectives and requirements to stakeholders 2) Compile a bontebok driven stakeholder conservation education strategy 3) Develop a communication strategy to communicate with stakeholders 4) Engage with DAFF to align the bontebok communication strategy with their initiatives 	
Expected Outcome in 5 yrs.:	1) Multi stakeholder involvement in bontebok conservation	
Monitoring and Evaluation:	1) Number of stakeholder engagements.	
Funding / Resources	Timeframe	Measurable Indicators / Outputs

Agency operational budgets	Within one year of implementation.	Approved People and Parks Conservation Strategy, Approved communication strategy
Challenges:		

Objective Target 3.3 Increase public awareness and education on the status and threats facing bontebok

Objective Target 3.2 Increase private sector investment and support for bontebok conservation

5.3.1.3 ACTION: DEVELOP NATIONAL BONTEBOK TRANSLOCATION GUIDELINES		
Lead agencies:	DEA ToPS	
Implementing agencies:	SANPARKS, CN, ECPTA, EC DEDEAT, FS DESTEA, NC DENC, NW DREAD	
Collaborators:	WRSA, SAHGCA, Private sector, NZG, Wildlife Translocation Association	
Essential activities:	1) Develop a national translocation guideline for bontebok	
Expected Outcome in 5 yrs.:	1) National effective compliance enforcement.	
Monitoring and Evaluation:	1) Documents guidelines.	
Funding / Resources	Timeframe	Measurable Indicators / Outputs
Agency operation budget	Within one year of gazetting	Approved National Translocation Guidelines for Bontebok.
Challenges:		

5.3.2.1 ACTION: DEVELOP INCENTIVES FOR STAKEHOLDERS TO PARTICIPATE IN AND CONTRIBUTE TO ACHIEVING THE OBJECTIVE OF THE BONTEBOK BMP-S.		
Lead agencies:	CN, SANParks, DEA	
Implementing agencies:	ECPTA, EC DEDEAT, FS DESTEA, NC DENC, NW DREAD, DAFF	
Collaborators:	WRSA, SAHGCA, Private sector, stewardship agencies	
Essential activities:	<ol style="list-style-type: none"> 1) Investigate and develop appropriate incentives for participation in bontebok conservation, in consultation with stakeholders 2) Develop incentive strategy for participation in the bontebok meta-population management strategy 3) Align incentives with Wildlife Economy Strategy 	
Expected Outcome in 5 yrs.:	1) Increased stakeholder participation in bontebok conservation	
Monitoring and Evaluation:	<ol style="list-style-type: none"> 1) Incentives developed 2) Incentive strategy developed for meta-population management 	
Funding / Resources	Timeframe	Measurable Indicators / Outputs
Agency operational budgets	Within two years of gazetting	Incentive strategy
Challenges:		

5.3.3.1 ACTION: IMPLEMENT ENVIRONMENTAL EDUCATION AND EXTENSION INITIATIVES TO PROMOTE AWARENESS ON THE STATUS AND THREATS FACING BONTEBOK.		
Lead agencies:	SANParks, CN	
Implementing agencies:	ECPTA, EC DEDEAT, FS DESTEA, NC DENC, NW DREAD	
Collaborators:	WRSA, SAHGCA, Private sector	
Essential activities:	<ol style="list-style-type: none"> 1) Develop resources and tools to facilitate environmental education and extension 2) Engage with DAFF land care programs (Smart Agric Program etc.) 	
Expected Outcome in 5 yrs.:	1) More informed public and stakeholders benefiting from flagship environmental awareness programmes	
Monitoring and Evaluation:	<ol style="list-style-type: none"> 1) Number of awareness materials/tools 2) Number of interventions implemented 	
Funding / Resources	Timeframe	Measurable Indicators / Outputs
Agency operational budget	Within two years of gazetting	Awareness tools/brochures developed Awareness interventions implemented
Challenges: Accurate and consistent information disseminated.		

5.4 OBJECTIVE 4: TO INVESTIGATE AND CONDUCT RESEARCH AIMED AT SUPPORTING ADAPTIVE MANAGEMENT AND THE IMPLEMENTATION OF BONTEBOK CONSERVATION

Objective Target 4.1 Conduct research into the viability of available habitat for bontebok

5.4.1.1 ACTION: IDENTIFY AND IMPLEMENT RESEARCH ON HABITAT MANAGEMENT (INCLUDING IMPROVEMENT, REHABILITATION AND POTENTIAL IMPACTS OF CLIMATE CHANGE) FOR BONTEBOK.		
Lead agencies:	CN, SANParks	
Implementing agencies:	Higher Education Institutions, Lowland Renosterveld Conservation Trust, Private sector	
Collaborators:	Higher Education Institutions, Lowland Renosterveld Conservation Trust, Private sector	
Essential activities:	<ol style="list-style-type: none"> 1) Identify research gaps and communicate research needs 2) Facilitate research to inform appropriate bontebok habitat management, (incorporate fire, alien vegetation, predation and game stocking where applicable) 3) Implement best-practice and research findings for integrated fire-alien vegetation-game stocking-predation for bontebok habitat management 4) Maintain a register of relevant research 5) Distribute research results in communication strategy. 	
Expected Outcome in 5 yrs.:	1) Appropriate research for bontebok conservation undertaken to inform strategic adaptive management strategies.	
Monitoring and Evaluation:	<ol style="list-style-type: none"> 1) Research projects registered and undertaken. 2) Publications 	

Funding / Resources	Timeframe	Measurable Indicators / Outputs
Agency operation budget	Immediate	Research papers/thesis Researcher database
Challenges: Communicating research requirements efficiently		

Objective Target 4.2 Conduct research into the effects of implemented policies for bontebok

5.4.2.1 ACTION: MONITOR THE IMPACTS OF THE IMPLEMENTATION OF A HYBRID THRESHOLD FOR TRANSLOCATIONS ON GENETIC DIVERSITY		
Lead agencies:	CN, NZG, SANParks	
Implementing agencies:	ECPTA, EC DEDEAT, FS DESTEA, NC DENC, NW DREAD, DEA ToPS & CITES	
Collaborators:	UFS, UWC, SUN, Cardiff University, Tennessee University, WRSA, Private sector	
Essential activities:	1) Research and develop appropriate monitoring framework to detect and predict potential impacts on the genetic diversity resulting from the implementation of a hybrid threshold value for translocations on source populations 2) Develop genetic management recommendations for reintroduced, reinforced and mixed sub-populations 3) Implement and monitor the effects of implementing genetic management recommendations for reintroduced, reinforced and mixed sub-populations	
Expected Outcome in 5 yrs.:	1) Effective Policy implementation and decrease in hybridisation events	
Monitoring and Evaluation:	3) Research project registered 4) Policy monitoring and evaluation framework	
Funding / Resources	Timeframe	Measurable Indicators / Outputs
Research funding to be sourced	Within four years of gazetting	Monitoring framework Research publications/thesis
Challenges: Funding		

Objective Target 4.3 Conduct health and fitness research of bontebok

5.4.3.1 ACTION: CONDUCT RESEARCH TO QUANTIFY THE EXTENT AND SEVERITY OF POSSIBLE DISEASE OCCURRENCE IN BONTEBOK.		
Lead agencies:	NZG, CN, SANParks	
Implementing agencies:		
Collaborators:	SUN, Higher Education Institutions, Private sector	
Essential activities:	1) Research and develop the screening of innate immunity genes in bontebok to identify disease associated mutations as well as determine diversity of these genes 2) Research aetiological agents of disease to further knowledge and understanding of epidemiology.	
Expected Outcome in 5 yrs.:	1) Research results published 2) Parasite prevalence data	
Monitoring and Evaluation:	1) Peer reviewed papers 2) Known parasite load and distribution.	

Funding / Resources	Timeframe	Measurable Indicators / Outputs
Research funding to be sourced	Within two years of gazetting	Parasite Load Assessments for sampled sub-populations
Challenges:		

5.4.3.2 ACTION: ASSESS THE REPRODUCTIVE FITNESS OF BONTEBOK SUB-POPULATIONS.		
Lead agencies:	NZG, CN, SANParks	
Implementing agencies:		
Collaborators:	UWC, Higher Education Institutions, Private sector	
Essential activities:	<ol style="list-style-type: none"> 1) Research and develop reproductive fitness assessment of bontebok: 2) Integrate results into management recommendations 3) Engage with State Vet to collaborate on research 	
Expected Outcome in 5 yrs.:	<ol style="list-style-type: none"> 1) Fundamental and applied research conducted to further knowledge and understanding of bontebok reproduction 	
Monitoring and Evaluation:	<ol style="list-style-type: none"> 1) Peer reviewed papers 	
Funding / Resources	Timeframe	Measurable Indicators / Outputs
Research funding to be sourced	Within two years of gazetting	Reproductive fitness assessments for known sub-populations
Challenges:		

6) BONTBOK BMP-S REPORTING FRAMEWORK

Below is the outline of the reporting framework based on the draft provided by DEA. It indicates the actions and the responsible reporting agencies.

ACTIONS	RESPONSIBLE AGENCY	TIMELINE	RESOURCES NEEDED	COLLABORATORS	DELIVERABLES	MEASURABLE OUTCOMES	PROGRESS	CHALLENGES / CORRECTIVE MEASURES
OBJECTIVE 1								
Objective Target 1.1								
Conserve genetically diverse meta-population								
1.1.1 Develop a sound meta-population management guideline.	CN, SANParks, SANBI: NZG, DAFF	Within two years of BMP being gazetted	Agency operational budget	Private sector, ECPTA, EC DEDEAT, NC DENC, WRSA, WPA, SAHGCA, Higher Education Institutions	Meta-population management implemented – increased genetic resilience/diversity	Meta-population management guideline; Assessment of sub-populations		
1.1.2 Investigate the genetic diversity of the bontbok and develop models and national protocols to maintain genetic diversity and integrity in bontbok.	CN, SANParks, DEA, NZG, ECPTA, EC DEDEAT, FS DESTEAT, NC DENC, NW DREAD	Immediate	Agency operational budget	UFS, UWC, Cardiff University, Tennessee University, WRSA, SAHGCA, Private sector, SUN, UCT	Standardised genetic testing. Genetic diversity of subpopulations known to inform adaptive management of meta-population strategy implementation.	Genetic sampling protocol standardised and implemented consistently in South Africa. Centralised depository		
Objective Target 1.2								
Safeguard bontbok against hybridisation								
1.2.1 Manage the risk of hybridisation of bontbok with blesbok.	SANParks, CN, ECPTA, EC DEDEAT, FS DESTEAT,	Immediate	Agency operational budget	WRSA, SAHGCA, Private sector	Decrease in instances of hybridisation	Hybrid detection and hybrid risk assessment protocols		

ACTIONS	RESPONSIBLE AGENCY	TIMELINE	RESOURCES NEEDED	COLLABORATORS	DELIVERABLES	MEASURABLE OUTCOMES	PROGRESS	CHALLENGES / CORRECTIVE MEASURES
1.2.2 Develop a list of priority sites for reinforcement and reintroduction.	NC DENC, NW DREAD CN, SANParks	Within two years of BMP being gazetted	Agency operational budget	SANBI	Increased distribution of viable bontebok sub-populations in NDR	Priority sites identified; Site assessment, translocation and prioritisation guideline		
Objective Target 1.3 Implement a meta population management framework								
1.3.1 Maintain a centralised national bontebok population database.	SANBI:NZG CN, SANParks, CN, ECPTA, EC DEDEAT, FS DESTEAT, NC DENC, NW DREAD	Immediate	Agency operational budget	SANBI, WRSA, SAHGCA, Private sector	National centralised distribution database established	Spatial bontebok distribution databases		
1.3.2 Maintain a centralised national bontebok genetics database.	SANBI:NZG, SANParks, CN, ECPTA, EC DEDEAT, FS DESTEAT, NC DENC, NW DREAD	Immediate	Agency operational budget	DEA, SANBI, WRSA, SAHGCA, WPA, Private sector	National centralised database established and linked to distribution database	Bontebok DNA profiles		
Objective Target 1.4 Long term monitoring of bontebok sub-populations								
1.4.1 Implement standardised bontebok survey	CN, SANParks, CN, ECPTA,	Immediate	Agency operational budget /	SANBI, WRSA, Private sector	Accurate population trend data informing	Precise game censuses;		

ACTIONS	RESPONSIBLE AGENCY	TIMELINE	RESOURCES NEEDED	COLLABORATORS	DELIVERABLES	MEASURABLE OUTCOMES	PROGRESS	CHALLENGES / CORRECTIVE MEASURES
and monitoring protocols for protected areas to inform adaptive management.	EC DEDEAT, NC DENC		Additional funding for aerial census required.		strategic adaptive management	standardised monitoring protocols		
1.4.2 Coordinate annual bontebok sub-population status reports.	SANBI, CN, SANParks, ECPTA, EC DEDEAT, FS DESTEAT, NC DENC, NW DREAD	Immediate	Agency operational budget	DEA	Quality bontebok sub-population data	Standardised annual reporting and status reports		
1.4.3 Monitor population performance and habitat condition for bontebok on private land.	CN, SANParks, ECPTA, EC DEDEAT, FS DESTEAT, NC DENC, NW DREAD	Within three years of the BMPs being gazetted	Agency operational budget/Contributions from Private Sector	SANBI, WPA, SAHGCA, Private Sector	Viable populations established and maintained	Standardised habitat and population assessments for introductions		
OBJECTIVE 2								
Objective Target 2.1								
Restore habitat and connectivity								
2.1.1 Implement habitat expansion through stewardship, custodianship and connectivity corridors in the	CN, SANParks, DAFF, conservation agencies	Immediate	Agency operational budget. Funding sourced for	DEA&DP, local municipalities Stewardship agencies, private landowners,	Increased distribution of bontebok in the natural distribution range	Fine-scale habitat map of possible stewardship/custodian sites		

ACTIONS	RESPONSIBLE AGENCY	TIMELINE	RESOURCES NEEDED	COLLABORATORS	DELIVERABLES	MEASURABLE OUTCOMES	PROGRESS	CHALLENGES / CORRECTIVE MEASURES
natural distribution range of bontebok.			land acquisition.	WWF/BirdLife SA ,NGOs		Prioritised expansion/custodian sites Habitat suitability matrix		
2.1.2 Develop guidelines and implement habitat rehabilitation in the natural distribution range of bontebok	CN, SANParks, DAFF, DEA&DP, local municipalities	Within two years of gazetting	Agency operational budget and sourcing of funding from NGOs	Stewardship agencies, BGCMA, FPAs, Higher Education Institutions, EPWP, SANBI	Increased availability of viable habitat, Decreased density of alien vegetation	Rehabilitation guidelines. Alien Vegetation Management hectares cleared		
OBJECTIVE 3								
Objective Target 3.1								
Establish and maintain partnerships for bontebok conservation								
3.1.1 Formalise inter-agency collaboration to coordinate and review the implementation of the bontebok BMP-S.	CN, SANPARKS, ECPTA, EC DEDEAT, FS DESTEAT, NC DENC, NW DREAD, DEA	Within year one of gazetting	Agency operational budget		Established and formalised Steering Committee; Improved inter-agency collaboration and coordination.	Formalised MoU ToR of Steering Committee, an inter-agency capacity development and exchange strategy		
3.1.2 Engage and collaborate with stakeholders for bontebok conservation.	CN, SANPARKS, ECPTA, EC DEDEAT, FS DESTEAT, NC	Within year one of gazetting	Agency operational budget	WRSA, SAHGCA, Private bontebok owners, NZG, Higher	Multi stakeholder involvement in bontebok conservation	Approved People and Parks Conservation Strategy, Approved communication strategy		

ACTIONS	RESPONSIBLE AGENCY	TIMELINE	RESOURCES NEEDED	COLLABORATORS	DELIVERABLES	MEASURABLE OUTCOMES	PROGRESS	CHALLENGES / CORRECTIVE MEASURES
	DENC, NW DREAD, DEA, DAFF			Education Institutions				
3.1.3 Develop national bontebok translocation guidelines	DEA:ToPS SANPARKS, CN, ECPTA, EC DEDEAT, FS DESTEAT, NC DENC, NW DREAD	Within year one of gazetting	Agency operational budget	WRSA, SAHGCA, Private sector, NZG, Wildlife Translocation Association	National effective compliance enforcement	Approved National Translocation Guidelines for bontebok.		
Objective Target 3.2 Increase private sector investment and support for bontebok conservation								
3.2.1 Develop incentives for stakeholders to participate in and contribute to achieving the objective of the bontebok BMP-S.	CN, SANParks, DEA ECPTA, EC DEDEAT, FS DESTEAT, NC DENC, NW DREAD, DAFF	Within two years of gazetting	Agency operational budget	WRSA, SAHGCA, Private sector, stewardship agencies	Stakeholder participation in bontebok conservation	Incentive strategy		
Objective Target 3.3 Increase public awareness and education on the status and threats facing bontebok								
3.3.1 Implement environmental education and extension initiatives to promote awareness on the	SANParks, CN ECPTA, EC DEDEAT, FS DESTEAT, NC	Within two years of gazetting	Agency operational budget	WRSA, SAHGCA, Private Sector	More informed public and stakeholders benefiting from flagship environmental	Awareness tools/brochures developed Awareness interventions implemented		

status and threats facing bontebok	DENC, NW DREAD	Immediate	Agency operational budget.	Higher Education Institutions, Lowland Renosterveld Conservation Trust, Private Sector	Appropriate research for bontebok conservation undertaken to inform strategic adaptive management strategies	Research papers/thesis Researcher database	awareness programmes	
OBJECTIVE 4 INVESTIGATE AND CONDUCT RESEARCH AIMED AT SUPPORTING ADAPTIVE MANAGEMENT AND THE IMPLEMENTATION OF BONTEBOK CONSERVATION								
Objective Target 4.1 Conduct research into the viability of available habitat for bontebok								
4.1.1 Identify and implement research on habitat management (including improvement, rehabilitation and potential impacts of climate change) for bontebok	CN, SANParks	Immediate	Agency operational budget.	Higher Education Institutions, Lowland Renosterveld Conservation Trust, Private Sector	Appropriate research for bontebok conservation undertaken to inform strategic adaptive management strategies	Research papers/thesis Researcher database		
Objective Target 4.2 Conduct research into the effects of implemented policies for bontebok conservation								
4.2.1 Monitor the impacts of the implementation of a hybrid threshold for translocations on genetic diversity	CN, NZG, SANParks, ECPTA, EC DEDEAT, FS DESTEAT, NC DENC, NW DREAD, DEA: ToPS & CITES	Within four years of gazetting	Research funding to be sourced	UFS, UWC, SUN, Cardiff University, Tennessee University, WRSA, Private sector	Effective Policy implementation and decrease in hybridisation events	Monitoring framework Research publications/thesis		
Objective Target 4.3 Conduct health and fitness research of bontebok								
4.3.1 Conduct research to quantify the extent and severity of possible disease occurrence in bontebok	SANBI: NZG, SANParks, CN	Within two years of gazetting	Research funding to be sourced	SUN, Higher Education Institutions, Private sector	Research results published, Parasite prevalence data	Parasite Load Assessments for sampled sub-populations		

4.3.2 Assess the reproductive fitness of bontebok sub-populations	SANBI:NZG, SANParks, CN	Within two years of gazetting	Research funding to be sourced	UWC, Higher Education Institutions, Private sector	Fundamental and applied research conducted to further knowledge and understanding of bontebok reproduction	Reproductive fitness assessments for known sub-populations		
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7) REFERENCES

2012. Report on how the International Union for Conservation of Nature is supporting the achievement of the Strategic Plan for Biodiversity 2011-2020 and the Aichi Biodiversity targets. Secretary, e. Hyderabad, India, Conference of the parties to the Convention on Biological Diversity.
- (PMG)., P. M. G. 2014. "Minutes - Provincial conservation: support, resources, challenges and constraints in implementing conservation mandate: Department of Environmental Affairs briefing." Retrieved 17 February, 2016., from <https://pmg.org.za/committee-meeting/17878/>.
- Akçakaya, H. R., Mills, G.,Doncaster, C. P. 2007. The role of Meta-populations in conservation. Macdonald, D.,Service, K. Key Topics in Conservation Biology. Blackwell Publishing, Oxford, UK. 64 - 84.
- Allendorf, F., Leary, R., Spruell, P.,Wenburger, J. 2001. "The problems with hybrids: setting conservation guidelines." *Trends in Ecology & Evolution* 16, 613-622.
- Barnard, P. J.,van der Walt, K. 1961. Translocation of Bontebok *Damaliscus pygargus* from Bredasdorp to Swellendam, Cape Parks and Division of Veterinary Services.
- Birss, C. 2014. Conservation in a Regulatory Framework Kotze, A., Lane, E. ,Nxomani, C. One Health. Centre for Wildlife Health, National Zoological Garden of South Africa, Pretoria.
- Birss, C., Rushworth, I., Collins, N.B., Peinke, D. & Buijs, D. 2015. Inferred Natural distribution ranges of large mammals in South Africa, Version 1. Unpublished GIS coverage.
- Boomker, J.,Horak, I. G. 1992. "Parasites of South African wildlife. XIII. Helminths of grey rhebuck, *Pelea capreolus*, and of bontebok, *Damaliscus dorcas dorcas*, in the Bontebok National Park." *Onderstepoort Journal of Veterinary Research* 59, 175-182.
- Boomker, J., Horak, I. G., Gibbons, L. M.,De Vos, V. 1983. "Haemonchus contortus from the vaal ribbok *Pelea capreolus*, and the bontebok *Damaliscus dorcas dorcas*, in the Bontebok National Park." *Onderstepoort Journal of Veterinary Research* 50, 179-181.
- Boomker, J. D. F. 1990. A comparative study of the Helminth fauna of browsing antelope of South Africa, Medical University of South Africa. DSc.
- Boshoff, A. F., Landman, M.,Kerley, G. I. H. 2015. Filling the gaps on the maps: historical distribution patterns of some larger mammals in part of southern Africa. *Transactions of the Royal Society of South Africa*, Pretoria, University of South Africa Press.
- Broders, H., Mahoney, S., Montevecchi, W.,Davidson, W. 1999. "Population genetic structure and the effect of founder events on the genetic variability of moose, *Alces alces*, in Canada." *Molecular Ecology* 8, 1309-1315.
- Burger, B. V., Le Roux, M., Garbers, C. F., Spies, H. S. C., Bigalke, R. C., Pachler, K. G. R., Wessels, P. L., Christ, V.,Maurer, K. H. 1976. "Studies on mammalian pheromones I. Ketones from the pedal gland of the bontebok (*Damaliscus dorcas dorcas*)." *Zeitschrift fur Naturforschung A: Journal of Physical Sciences* 32, 21-28.
- Burger, B. V., Le Roux, M., Garbers, C. F., Spies, H. S. C., Bigalke, R. C., Pachler, K. G. R., Wessels, P. L., Christ, V.,Maurer, K. H. 1977. "Further compounds from the pedal gland of the bontebok (*Damaliscus dorcas dorcas*)." *Zeitschrift fur Naturforschung A: Journal of Physical Sciences* 32, 49-56.
- Carr A.S., Chase B.M. and Mackay A. 2016. Mid to Late Quaternary landscape and environmental dynamics in the Middle Stone Age of southern South Africa. In: Jones S.C. and Stewart B.A. (eds) *Africa from MIS 6-2: Population dynamics and Paleoenvironments, Vertebrate Paleobiology and Paleoanthropology*. DOI 10.1007/978-94-017-7520-5_2
- Compton J.S. 2011. Pleistocene sea-level fluctuations and human evolution on the southern coastal plain of South Africa. *Quaternary Science Reviews* 30:506-527.
- Cowling, R. M., Pierce, S. M.,Moll, E. J. 1986. "Conservation and utilisation of South Coast Renosterveld, an endangered South African vegetation type." *Biological Conservation* 37, 363-377.
- de Graaff, G.,Penzhorn, B. 1976. "The re-introduction of springbok *Antidorcas marsupialis* into South African National Parks—A documentation." *Koedoe* 19, 75-82.

- Du Toit, J. G., E., v. M.-K., Bothma, J. d. P. 2010. Genetic Management. Bothma, J. d. P., Du Toit, J. G. Game Ranch Management. Van Schaik Publishers, Pretoria. 391-401.
- Elmhagen, B., Angerbjörn, A. 2001. "The applicability of Meta-population theory to large mammals." OIKOS 94, 89-100.
- Essop, M. F., Harley, E. H., Lloyd, P. H., Van Hensbergen, H. J. 1991. "Estimation of the genetic distance between bontebok and blesbok using mitochondrial DNA." South African Journal of Science 87, 271-273.
- Estes, R. D. 1992. The behaviour guide to African Mammals. University of California Press, Ltd., London, England.
- Fabricius, C., Van Hensbergen, H. J., Zucchini, W. 1989. "A discriminant function for identifying hybrid bontebok X blesbok populations." South African Journal of Wildlife Research 19, 2.
- Fabriscius, C. 1991. "Bontebok and its hybrids: how to tell the difference." Natura 25: 34-35.
- Faith J.T. 2011. Ungulate community richness, grazer extinctions, and human subsistence behaviour in southern Africa's Cape Floral Region. Palaeogeography, Palaeoclimatology, Palaeoecology 306:219-227.
- Faith J.T. 2012. Palaeozoological insights into management options for a threatened mammal: southern Africa's Cape mountain zebra (*Equus zebra zebra*). Diversity and Distributions 18:438-447.
- Faith J.T. and Behrensmeier A.K. 2013. Climate change and faunal turnover: testing the mechanics of the turnover-pulse hypothesis with South African fossil data. Paleobiology 39(4):609-627.
- Frankham, R., Ballou, J. D., Briscoe, D. A. 2002. Introduction to Conservation Genetics. Cambridge University Press, Cambridge. United Kingdom.
- Fujimoto, T., Hotei, Y., Takeuchi, H., Tanaka, S., Ohta, K., Yamamoto, I. 1991. "Chemistry of cyclic phosphorous compounds. 4. Syntheses of the sex pheromone from the pedal gland of bontebok and some 1,4-Diketones by use of 1,1-Diphenylphosphonium Perchlorate." Journal of Organic Chemistry 56, 4799-4802.
- Furstenburg, D. 2016. BONTBOK *Damaliscus pygargus pygargus* (Pallas, 1766). Wildlife Biologist Scientific Report. GEO WILD Consult (Pty) Ltd.
- Goitom, H. 2013. "Wildlife Trafficking and Poaching: South Africa." Retrieved 17 February 2016, from <https://www.loc.gov/law/help/wildlife-poaching/southafrica.php>
- Gray, A. P. 1971. Mammalian Hybrids - A Checklist with Bibliography. Farnham Royal, Slough SL2 3BN. England, Commonwealth Agricultural Bureaux.
- Grubb, P. 1993. Order Artiodactyla. In Wilson, D.E. & Reeder, D.M. (eds.) Mammal Species of the World, Second Edition. Smithsonian Institution Press, Washington and London.: 377-414.
- Hanski, I. 1999. Meta-population Ecology. Oxford University Press, Oxford, UK.
- Helm C., Cawthra H., Cowling R., De Vynck J., Marean C., McCrea R. and Rust R. 2018. Palaeoecology of giraffe tracks in Late Pleistocene aeolianites on the Cape south coast. South African Journal of Science 114(1/2); 8 pages.
- Hoag C. and Svenning J-C. 2017. African environmental change from the Pleistocene to the Anthropocene. Annual Review of Environment and Resources 42:27-54.
- Horak, I. G., Boomker, J. 1998. "Parasites of domestic and wild animals in South Africa: XXXV: ixodid ticks and bot fly larvae in the Bontebok National Park." The Onderstepoort Journal of Veterinary Research 65, 205-211.
- Horak, I. G., Brown, M. R., Boomker, J., De Vos, V., Van Zyl, E. A. 1982. "Helminth and arthropod parasites of blesbok *Damaliscus dorcas phillipsi* and of bontebok *Damaliscus dorcas dorcas*." Onderstepoort Journal of Veterinary Research 49, 139-146.
- Horak, I. G., L.J., F., Boomker, J. 1997. "A ten-year study of ixodid tick infestations of bontebok and grey rhebok in Western Cape Province, South Africa." South African Journal of Wildlife Research 27, 5-10.
- Horak, I. G., Sheppey, K., Knight, M. M., Beuthin, C. L. 1986. "Parasites of domestic and wild animals in South Africa. XXI. Arthropod parasites of vaal ribbok, bontebok and scrub hares in the western Cape Province." Onderstepoort Journal of Veterinary Research 53, 187-197.

- Klein R.G. 1980. Environmental and ecological implications of large mammals from Upper Pleistocene and Holocene sites in southern Africa. *Annals of the South African Museum* 81:223-283.
- Klein R.G. 1983. Palaeoenvironmental implications of Quarternary large mammals in the fynbos region. In: H.J. Deacon, Q.B. Hendey and J.J.N. Lambrechts (eds). *Fynbos palaeoecology: a preliminary synthesis*. South African National Scientific Programmes Report 75:116-138, Cape Town.
- Klein R.G. and Cruz-Urbe K. 1987. Large mammal and tortoise bones from Eland's Bay Cave and nearby sites, Western Cape Province, South Africa. Pp. 132-163 In: J.E. Parkington and M. Hall (eds). *Papers in the prehistory of the Western Cape, South Africa*. BAR International Series 322. Archaeopress, Oxford.
- Kotze, A., Nxomani, C. 2011. "The National Zoological Gardens of South Africa: a National Research Facility." *International Zoo Yearbook* 45, 30-37.
- Kovalev, B. G., Sorochinskaya, A. M., Avdeeva, L. 1986. "Synthesis of cis-undec-5-en-2-one - the pheromone of the pedal glands of *Damaliscus dorcas dorcas*." *Chemistry of Natural Compounds* 22, 122.
- Kraaij, T., Novellie, P. A. 2010. "Habitat selection by large herbivores in relation to fire at the Bontebok National Park (1974–2009): the effects of management changes." *South African Journal of Range and Forage Science* 27, 21-27.
- Krug, R. M., Krug, C. B., Iponga, D. M., Newton, I. P., Shiponeni, N. N., Walton, B. A., Milton, S. J. 2004. *Reconstructing ecological processes in West Coast Renosterveld: the grazers, the fires and the humans*. Fynbos Forum. Langebaan: 36.
- Kumamoto, A. T., Charter, S. J., Houck, M. L., Frahm, M. 1996. "Chromosomes of *Damaliscus* (Artiodactyla, Bovidae): simple and complex centric fusion rearrangements." *Chromosome Research* 4, 614-621.
- Lindsey, P. A., Roulet, P. A., Romanach, S. S. 2007. "Economic and conservation significance of the trophy hunting industry in sub-Saharan Africa." *Biological Conservation* 134, 455 - 469.
- Luyt, E. d. C. 2005. Models of bontebok (*Damaliscus pygargus pygargus*, Pallas 1766) habitat preferences in the Bontebok National Park and sustainable stocking rates. Stellenbosch, University of Stellenbosch. MSc: 111.
- Margules, C. R. 2000. "Systematic conservation planning." *Nature* 405, 243-253.
- Mucina, L., Rutherford, M. C. 2006. The vegetation of South Africa, Lesotho and Swaziland. . South African National Biodiversity Institute, Pretoria.
- Myers, N., Mittermeier, R. A., Mittermeier, C. G., Fonseca, G. A. B. d., Kent, J. 2000. "Biodiversity hotspots for conservation priorities." *Nature* 403, 853-858.
- Novellie, P. 1986. "Relationships between rainfall, population density and the size of the bontebok lamb crop in the Bontebok National Park." *South African Journal of Wildlife Research* 16, 39-46.
- Novellie, P. 1987. "Interrelationships between fire, grazing and grass cover at the Bontebok National Park." *Koedoe* 30, 1-17.
- Novellie, P., Kraaij, T. 2010. "Evaluation of Themeda triandra as an indicator for monitoring the effects of grazing and fire in the Bontebok National Park." *Koedoe* 52, 1-5.
- Olivier, P. I., Van Aarde, R. J., Ferreira, S. M. 2009. "Support for a Meta-population structure among mammals." *Mammal Review* 39, 178 - 192.
- Ortlepp, R. J. 1962. "Lungworms from South African antelopes." *Onderstepoort Journal of Veterinary Research* 29, 173-181.
- Penzhorn, B. L. 1971. "A summary of the re-introduction of ungulates into South African National Parks (to December 1970)." *Koedoe* 14, 145 - 159.
- Penzhorn, B. L., Novellie, P. A. 1991. "Some behavioural traits of Cape mountain zebras (*Equus zebra zebra*) and their implications for the management of a small conservation area." *Applied Animal Behavioural Science* 29, 293 - 299.
- Skead, C. J. 1982. Historical Mammal Incidence in the Cape Province. Western and Northern Cape. Cape Town, Department of Nature and Environmental Conservation. 1.

- Skead, C. J. 2011. Historical Incidence of the Larger Land Mammals in the Broader Northern and Western Cape. Second Centre for African Conservation Ecology and the Nelson Mandela Metropolitan University, Port Elizabeth.
- Skinner, J. D., Chimimba, C. T. 2005. The mammals of the southern African subregion. Cambridge University Press, Cambridge.
- Skinner, J. D., Smithers, R. H. N. 1990. The Mammals of the Southern African Subregion. Pretoria University Press, Pretoria.
- Steele T.E. 2007. Late Pleistocene of Africa. Vertebrate Records. Pp. 3139-3150.
- Strauss, T. 2015. Cape mountain zebra (*Equus zebra zebra*) habitat use and diet in the Bontebok National Park, South Africa., Nelson Mandela Metropolitan University. PhD: 179.
- Sutton M.B., Pickering T.R., Brain C.K., Clarke R.J. Heaton J.L. and Kuman K. 2009. Newly discovered fossil- and artefact-bearing deposits, uranium series ages, and Plio-Pleistocene hominids at Swartkrans Cave, South Africa. *Journal of Human Evolution* 57:688-696.
- Rector A.L. and Reed K.E. 2010. Middle and Late Pleistocene faunas of Pinnacle Point and their paleoecological implications. *Journal of Human Evolution* 59:340-357.
- Van der Walt, J., Nel, L. H., Hoelzel, A. R. 2001. "Characterization of major histocompatibility complex DRB diversity in the endemic South African antelope *Damaliscus pygargus*: a comparison in two subspecies with different demographic histories. ." *Molecular Ecology*. 10, 1679-1688.
- Van Rensburg, A. P. J. 1975. "Die geskiedenis van die Nasionale Bontebokpark, Swellendam." *Koedoe* 18, 165-190.
- Van Wyk, A. M., Dalton, D. L., Hoban, S., Bruford, M. W., Russo, I., Birss, C., Grobler, P., Janse van Vuuren, B., Kotze, A. 2016. "Quantative evaluation of hybridization and the impact on biodiversity conservation." *Ecology and Evolution* in press.
- Van Wyk, A. M., Kotze, A., Randi, E., Dalton, D. L. 2012. "A hybrid dilemma: a molecular investigation of South African bontebok (*Damaliscus pygargus pygargus*) and blesbok (*Damaliscus pygargus phillipsi*)." *Conservation Genetics Resources Springer Science+Business Media B.V. Journal* 16.
- Van Wyk, A. M., Kotzé, A., Randi, E., Dalton, D. L. 2013. "A hybrid dilemma: a molecular investigation of South African bontebok (*Damaliscus pygargus pygargus*) and blesbok (*Damaliscus pygargus phillipsi*)." *Conservation Genetics* 14, 589-599.
- Verster, A., Imes, G. D., Smit, J. P. J. 1975. "Helminths recovered from the bontebok *Damaliscus dorcas dorcas* (Pallas, 1766). ." *Onderstepoort Journal of Veterinary Research* 42, 29-32.
- Vrba, E. 1979. "Phylogenetic analysis and classification of fossil and recent Alcelaphini Mammalia, Bovidae. ." *Biological Journal of the Linnean Society* 11, 207-228.
- Vrba E.S. 1997. New fossils of Alcelaphini and Caprinae (Bovidae, Mammalia) from Awash, Ethiopia, and phylogenetic analysis of Alcelaphini. *Paleontologia Africana* 34:127-198.
- Winkler, A., Owen-Smith, N. 1995. "Habitat utilisation by Cape mountain zebras in the mountain Zebra National Park, South Africa." *Koedoe* 38, 83-93.
- Zumpt, I. F., Heine, E. W. P. 1978. "Some veterinary aspects of bontebok in the Cape of Good Hope Nature Reserve." *South African Journal of Wildlife Research* 8, 131-134.

APPENDIX A: BONTEBOK BMP-S WORKSHOP AGENDA



South African
NATIONAL PARKS



BONTEBOK BIODIVERSITY MANAGEMENT PLAN WORKSHOP**VENUE: CRC HALL****28 November 2013****Purpose of Workshop:**

The aim of this workshop is to produce a draft biodiversity management plan for bontebok. The draft BMP-s will then be summarized and presented to the workshop participants for comment. Following this the BMP-s will be submitted for gazetting and on approval will be published.

WELCOME AND INTRODUCTION	08h30-08h45	Carly Cowell
Feedback of NDF	08h45-09h15	Jeanetta Selier
Presentation status of bontebok, selection for BMP-s	09h15-09h30	Coral Birss
Overview of BMP	09h30-10h00	Coral Birss
TEA	10h00-10h30	
BMP-s Planning Outline	10h30-10h50	Coral Birss
Desired state formulation	10h50-11h50	Carly Cowell
Hierarchy of objectives	11h50-12h45	Carly Cowell
LUNCH	12h45-13H30	
Threat identification	13h30-14h00	Carly Cowell
Action plans outlines	14h00-15h00	Group work
TEA	15h00	
Close & way forward	15h00-15h30	Coral & Carly



environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

**APPENDIX A: BONTEBOK BMP-S WORKSHOP PARTICIPANTS**

Name	Organisation	Email address
Bontle Morwe	DEA	morweb@detea.fs.gov.za
Buntu Mzamo	DEDEAT	buntu.mzamo@dedea.gov.za
Carly Cowell	SANParks	Carly.Cowell@sanparks.org
Christine Kraft	Department of Environment Northern Cape	christine.dtec@gmail.com
Coral Birss	CapeNature	cbirss@capenature.co.za
Danelle Kleinhans	CapeNature	dkleinhans@capenature.co.za
Deon Hignett	CapeNature	dhignett@capenature.co.za
David Zimmerman	SANParks	david.zimmerman@sanparks.org

Dean Peinke	Eastern Cape Parks and Tourism Agency	Dean.peinke@ecpta.co.za
Peter Novellie	SANParks	peter.novellie@sanparks.org
Guy Palmer	CapeNature	gpalmer@capenature.co.za
Jaco van Deventer	CapeNature	jvdeventer@capenature.co.za
Jeanetta Selier	South African National Biodiversity Institute	J.Selier@sanbi.org.za
Johan Strydom	Free State Bontebok Owners Association	strydomjak@telkomsa.net
Justin Buchman	SANParks	Justin.Buchman@sanparks.org
Mick D'Alton	Nuwejaars SMA-Agulhas	mandjaldalton@omail.co.za
Natalie Hayward	CapeNature	nhayward@capenature.co.za
Nosipho Tyagana	SANParks	nosipho.tyagana@sanparks.org
Conrad Matthee	Stellenbosch University	cam@sun.ac.za
Roland January	SANParks	Roland.January@sanparks.org
Stephen Mitchell	WRSA	smitchell@nashuaisp.co.za
Tebogo Mashua	DEA	TMashua@environment.gov.za
Trevor Adams	SANParks	Trevor.Adams@sanparks.org
Zishan Ebrahim	SANParks	zishan.ebrahim@sanparks.org

APPENDIX B: CONTRIBUTORS TO COMPILING THE BMP

- SANParks Working group and Contributors (Scientific Services, Veterinary Wildlife Services and Parks)
 - Carly Cowell
 - Trevor Adams
 - Roland January
 - Justin Buchman
 - Pierre Nel
 - Carmen Gagiano
 - Dr Nicola Van Wilgen
 - Dr Dave Zimmerman
 - Dr Peter Novellie
 - Dr Sam Ferreira
- CapeNature Technical Working Group and Contributors
 - Dr Andrew Turner
 - Natalie Hayward
 - Lee Saul
 - Johan Huisamen
 - Dr AnneLise Schutte-Vlok
 - Alexis Olds and Dr Antoinette Veldtman
 - Dr Ernst Baard
 - Gail Cleaver-Christie
 - Jaco van Deventer

- Deon Hignett
- Tom Barry
- Graham Lewis
- Blanche de Vries
- Coral Birss
- Ivan Donian

- February 2014: Comments and Contributions to first draft
 - Mick D'Alton
 - Steven Mitchell
 - Johan Strydom
 - Deon Hignett
 - Christine Kraft
 - Dave Zimmerman
 - Dean Pineke
 - Peter Novellie
 - Jeanetta Selier
 - Alan Southwood
 - Desire Dalton
 - Humbu Mafumo
 - Tebogo Mashua

- September 2016: Comments and Contributions to second draft
 - Mick D'Alton
 - Christine Kraft
 - Dave Zimmerman
 - Dean Pineke
 - Peter Novellie
 - Jeanetta Selier
 - Alan Southwood
 - Desire Dalton
 - Antoinette Kotze
 - Jaco van Deventer
 - Coral Birss
 - Guy Palmer
 - Thea Carroll
 - Humbu Mafumo
 - Tebogo Mashua

- **Jan-Mar 2019: Comments and contribution to the final draft**
 - Coral Birss
 - Ernst Baard
 - Jaco van Deventer
 - Humbu Mafumo
 - Tebogo Mashua
 - Jeanetta Seliers

APPENDIX C: TEMPLATE FOR SUGGESTED EDITS/ADDITIONS/CHANGES

TEMPLATE FOR SUGGESTED EDITS / ADDITIONS / CHANGES TO THE DRAFT	
Section:	Page:
Section content:	
Nature of comment:	Edit / Change / Deletion / Addition / Recommendation
Action taken:	
NOTES:	
Section:	Page:
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Nature of comment:	Edit / Change / Deletion / Addition / Recommendation
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Nature of comment:	Edit / Change / Deletion / Addition / Recommendation
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NOTES:	

APPENDIX D:

AGENDA

**BONTEBOK BIODIVERSITY MANAGEMENT PLAN:
ACTIONS AND RELEVANT AGREEMENTS WORKSHOP**
VENUE: Cape Research Centre 22 November 2016

Purpose of Workshop:

The aim of this workshop is to facilitate further collaboration between stakeholders to enable agreement between Lead and Implementing Agents for the successful implementation of the Bontebok BMP.

Tea	9:00 – 9:10	
DEA Welcome & Introduction	9:10 – 9:20	Wilma Lutsch
Overview of Process & Plan for the Day	9:20 – 9:40	Natalie Hayward
Icebreaker	9:30 – 10:40	All
Tea	10:40 – 10:50	
Session 1: Agreement on Action Plan	10:50 – 12:30	Natalie Hayward & All
Lunch	12:30 – 13:00	
Session 2: Agreement on Action Plan	13:00 – 14:45	Natalie Hayward & All
Wrap Up	14:45	Natalie Hayward
The Way Forward & Close	15:00	Carly Cowell

APPENDIX D: ATTENDANCE REGISTER AND INVITEE LIST FOR THE ACTIONS AND RELEVANT AGREEMENTS WORKSHOP FOR THE IMPLEMENTATION OF THE BONTEBOK BMP-S.

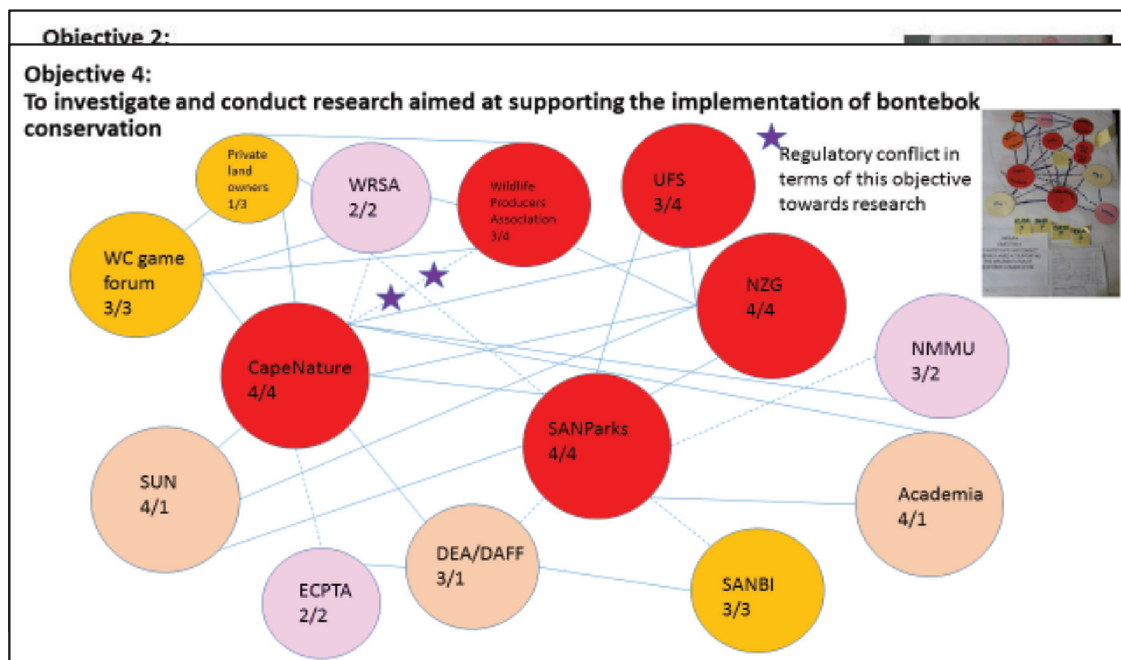
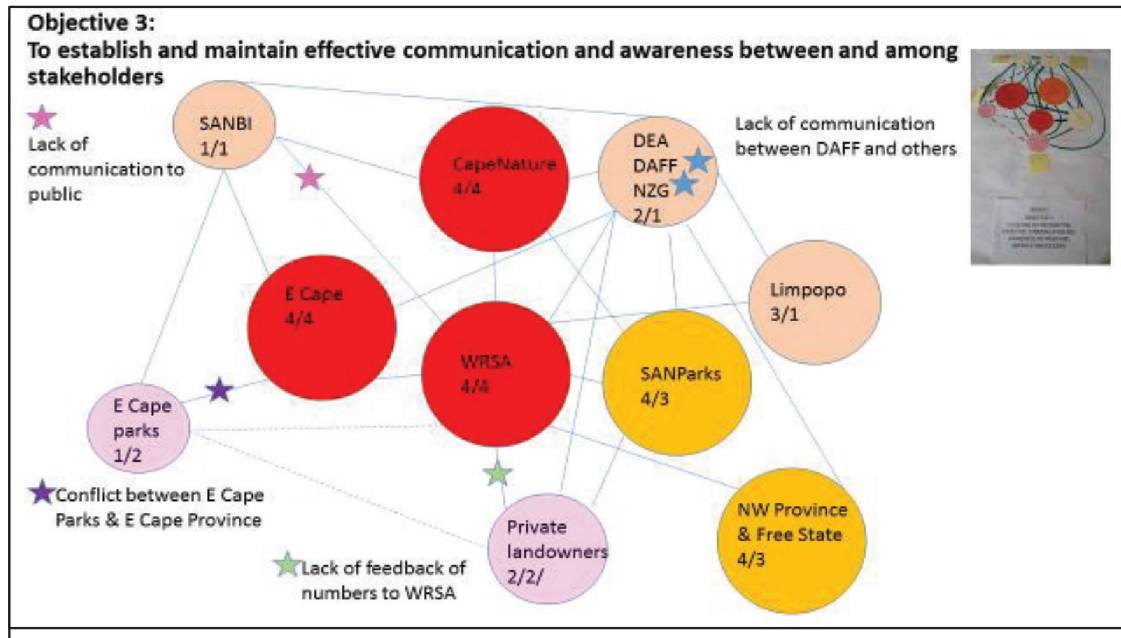


ATTENDANCE REGISTER

BONTEBOK BIODIVERSITY MANAGEMENT PLAN:
ACTIONS AND RELEVANT AGREEMENTS WORKSHOP
VENUE: Cape Research Centre
22 November 2016

NAME	ORGANISATION	CONTACT DETAILS	SIGNATURE
J Buchmann	SANPARKS	021 780 9100	
C Cowell	SANPARKS	021 713 7520	
S E van Niekerk	Denel COR	028 445 2119	
Dean L. Higgett	CAJ	021 4930117	
Dean Furstenberg	GeoWildConserv/WPA	0725253287 dean@geowild.co.za	
Coral Bliss	CapeNature	031 866 8000	
Gail Cleaver	CapeNature	021 4830002	
Natalie Hayward	CapeNature	021 866 8000	
Antoinette Orla	NYG	0834566902	
Leonard Madue	U-Stellenbosch	0844524244	
Seartha Selvi	SANBI	08345 55063	
Jaco van der Vliet	Adventure	082 455 5566	
MIKE DALTON	NUMERARY SIMA	082 69 59 835	
Aumbi Mafua	DEA	082 485 8499	
Eugene Mashula	DEA	082 838 1082	
Ernst Daard	CapeNature	021 483 0003	
Conrad Kahls	WRSA	082 457 3960	
S. Morais	KRC CAJTEL	021 302 9553	
MIKE GREGOR	ELANDSBERG	082 564 5667	
Wilma Weber	DEA	012 379 8827	

APPENDIX E: VENN DIAGRAMS ON STAKEHOLDER RELATIONSHIPS TOWARDS ACHIEVING THE OBJECTIVES OF THE BMP-S: ACTIONS AND RELEVANT AGREEMENTS WORKSHOP FOR THE IMPLEMENTATION OF THE BONTEBOK BMP-S.



APPENDIX F: SUMMARY OF THE FIVE CRITERIA (A-E) USED TO EVALUATE IF A TAXON BELONGS IN AN IUCN RED LIST THREATENED CATEGORY (CRITICALLY ENDANGERED, ENDANGERED OR VULNERABLE).¹

A. Population size reduction. Population reduction (measured over the longer of 10 years or 3 generations) based on

	Critically Endangered	Endangered	Vulnerable
A1	≥ 90%	≥ 70%	≥ 50%
A2, A3 & A4	≥ 80%	≥ 50%	≥ 30%
A1 Population reduction observed, estimated, inferred, or suspected in [except A3] the past where the causes of the reduction are clearly reversible AND AND have ceased.			(a) direct observation (b) an index of abundance understood appropriate to the taxon
A2 Population reduction observed, estimated, inferred, or suspected in the occupancy past where the causes of reduction may not have ceased OR may not be understood OR may not be reversible.			(c) a decline in area of (AOO), extent of (EEO) and/or habitat
B. Geographic range in the form of either B1 (extent of occurrence) AND/OR B2 (area of occupancy)			
	Critically Endangered	Endangered	Vulnerable
B1. Extent of occurrence (EOO)	< 100 km ²	< 5,000 km ²	< 20,000 km ²
B2. Area of occupancy (AOO)	< 10 km ²	< 500 km ²	< 2,000 km ²
AND at least 2 of the following 3 conditions:			
(a) Severely fragmented OR Number of locations	= 1	≤ 5	≤ 10
(b) Continuing decline observed, estimated, inferred or projected in any of: (i) extent of occurrence; (ii) area of occupancy; (iii) area, extent and/or quality of habitat; (iv) number of locations or subpopulations; (v) number of mature individuals			
(c) Extreme fluctuations in any of: (i) extent of occurrence; (ii) area of occupancy; (iii) number of locations or subpopulations; (iv) number of mature individuals			
C. Small population size and decline			
	Critically Endangered	Endangered	Vulnerable
Number of mature individuals	< 250	< 2,500	< 10,000
AND at least one of C1 or C2			
C1. An observed, estimated or projected continuing decline of at least (up to a max. of 100 years in	25% in 3 years or 1 generation (whichever is	20% in 5 years or 2 generations (whichever is	10% in 10 years or 3 generations (whichever is
C2. An observed, estimated, projected or inferred continuing decline AND at least 1 of the following 3			
(a) (i) Number of mature individuals in each	≤ 50	≤ 250	≤ 1,000
(ii) % of mature individuals in one subpopulation = 90–100%		95–100%	100%
(b) Extreme fluctuations in the number of mature			
D. Very small or restricted population			
	Critically Endangered	Endangered	Vulnerable
D. Number of mature individuals	< 50	< 250	D1. < 1,000
D2. Only applies to the VU category			D2. typically: AOO < 20 km ² or number of locations <
Restricted area of occupancy or number of locations with	-	-	
E. Quantitative Analysis			
	Critically Endangered	Endangered	Vulnerable

Indicating the probability of extinction in the wild to be:	≥ 50% in 10 years or 3 generations, whichever is longer (100 years max.)	≥ 20% in 20 years or 5 generations, whichever is longer (100 years max.)	≥ 10% in 100 years
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1 Use of this summary sheet requires full understanding of the *IUCN Red List Categories and Criteria* and *Guidelines for Using the IUCN Red List Categories and Criteria*.
Please refer to both documents for explanations of terms and concepts used here.