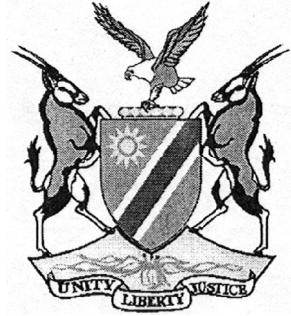


*DRAFT*



Ministry of Environment and Tourism  
Republic of Namibia

## SPECIES MANAGEMENT PLAN

### **Southern Reedbuck**

*Redunca arundinum arundinum*

### **Common Waterbuck**

*Kobus ellipsiprymnus ellipsiprymnus*

### **Red Lechwe**

*Kobus leche leche*

### **Puku**

*Kobus vardoni*

May 2003

# *DRAFT*

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## GLOSSARY AND DEFINITION OF TERMS

### Acronyms

DPW	- Directorate of Parks and Wildlife
DSS	- Directorate of Scientific Services
DWNP	- Department of Wildlife and National Parks, Botswana
MET	- Ministry of Environment and Tourism
NNF	- Namibia Nature Foundation
WWF LIFE	- World Wide Fund for Nature: Living In a Finite Environment programme

### Definition of Terms

*Background Study*: This refers to the *Species Report for Reedbuck, Waterbuck, Lechwe and Puku* prepared under the Ministry of Environment and Tourism's **Transboundary Mammal Project** (Martin 2004).

*Roan, Sable and Tsessebe Management Plan*: This refers to the *Species Management Plan for Roan, Sable and Tsessebe* prepared under the **Transboundary Mammal Project** of the Ministry of Environment and Tourism (Martin 2003b).

*Buffalo Management Plan*: This refers to the *Species Management Plan for Southern Savanna Buffalo* prepared under the **Transboundary Mammal Project** of the Ministry of Environment and Tourism (Martin 2002b)

“Caprivi” and “Caprivi Strip”: The word ‘Caprivi’ is used throughout the Plan to refer to the ‘peninsula’ of land extending eastwards from the north-eastern corner of Namibia as far as its junction point with Botswana, Zambia and Zimbabwe at the confluence of the Chobe and Zambezi Rivers. The phrase ‘Caprivi Strip’ is reserved for the narrow ‘isthmus’ connecting the broader part of the peninsula to the main body of Namibia.

Population, Subpopulation and Metapopulation: In this report, a population is any viable breeding group of a species; a subpopulation is one of a number of breeding groups which, when considered with other subpopulations, makes up a metapopulation. In a metapopulation there are usually two or more subpopulations which, in the normal course of events, are not in breeding contact with each other.

The “Project”: A number of situations have occurred in the Plan, particularly in the development of budgets, where it has been necessary to refer to the expected process of implementation of the Plan. Although no formal project proposal has yet been developed for this purpose, the term “project” is used to refer to the activities which would follow adoption of the Plan.

“Kasane Workshop”: A workshop was held in Kasane, Botswana on 30th November and 1st December 2002 in which representatives of the Namibian Ministry of Environment and Tourism and the Botswana Department of Wildlife and National Parks participated with the aim of collaboration on joint management issues affecting the buffalo population shared between the two countries. The *Background Study* to the Plan (*Species Report for Southern Savanna Buffalo*, Martin 2002a) was presented at the workshop.

“Windhoek Workshop”: A workshop was held in Windhoek on 23rd September 2003 in which representatives of the Namibian Ministry of Environment and Tourism and the Botswana Department of Wildlife and National Parks participated with the aim of collaboration on joint management issues affecting roan, sable and tsessebe. The *Background Study* and *Management Plan* for roan, sable and tsessebe were presented at the workshop.

**ACKNOWLEDGMENTS**

People from Namibia who contributed their time and valuable experience towards preparation of the Plan include Ben Beytell (Director, DPW), Pauline Lindeque (Director, DSS), Peter Erb (DSS), Chris Brown (Namibia Nature Foundation), Chris Weaver (WWF LIFE programme), Barbara Paterson (Transboundary Mammal Project of the Ministry of Environment and Tourism), John Mendelsohn (Directorate of Environmental Affairs) and a large number of others.

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## EXECUTIVE SUMMARY

The distribution of reedbuck, waterbuck, lechwe and puku populations in southern Africa are shown in **Map 1**. It is clear that the populations in Namibia are at the edge of the species range. The 'natural range' for reedbuck, waterbuck, lechwe and puku in Namibia is limited to the Caprivi. Within the Caprivi (20,000km<sup>2</sup>), the species are restricted to the floodplains (4,500km<sup>2</sup>). These habitats are highly sought after by humans for agriculture and cattle grazing and, in the year 2004, it is estimated that only 3,200km<sup>2</sup> of the original floodplain habitats remain. Only 500km<sup>2</sup> of these floodplains are protected in national parks (2½ %) and the area is broken into four isolated parts. The pressure caused by cattle grazing on the remaining 2,700km<sup>2</sup> of floodplains outside protected areas is extremely high (**Map 2**).

The wetland grazer populations in the Caprivi have fluctuated over the past century from being relatively abundant to being near extinction. The fluctuations appear to be linked to long term rainfall cycles (**Fig. 1**). Being on the fringe of larger populations in Botswana, they have usually been able to recover from low levels when the rainfall regime is favourable. Today, the population levels of all four species are a matter for concern: puku are almost extinct; waterbuck have been seen sporadically on surveys but, since 1994, there are no records exceeding 20 animals; lechwe have slumped from nearly 13,000 in 1980 to fewer than 200 now; and reedbuck numbers are about 200 at best.

Significant numbers of reedbuck, waterbuck and lechwe have been established on private land in northern Namibia. The number of reedbuck is uncertain but there are more than 3,500 waterbuck and over 200 lechwe (**Maps 3 & 4**). However, these populations are outside the 'natural range' of the species and the emphasis in this management plan is on the area where the species should be abundant – in the floodplains of the Caprivi.

Because of the dependency of reedbuck, waterbuck, lechwe and puku populations on rainfall, there will be long periods during which, despite the best management performance, little can be done to increase species numbers. This plan relies on **maintaining viable breeding nuclei of all four species** when the long term rainfall regime is in a deficit mode, and enabling species populations to respond rapidly when environmental conditions are favourable by ensuring habitats are available and other potentially limiting factors are minimised.

Waterbuck and puku numbers may have fallen below the threshold where they can recover and it is recommended that viable breeding nuclei are re-established by **introducing significant numbers of these species** to the Caprivi.

A list of potentially limiting factors is given in **Fig. 2** and, of these, by far most serious are the loss of habitat caused by clearing land for agriculture in the floodplains, the degradation of habitats caused by cattle grazing and the effects of direct competition with cattle for food. The effects of uncontrolled fires, illegal hunting, an overabundance of elephants are secondary but potentially limiting when populations should be increasing.

It is clear that the future for the wetland grazers is inextricably tied to the future of the floodplains in the Caprivi. It is doubtful whether species populations which will be viable in the long term can be secured within the protected areas. Greater areas of floodplain need to be available to reedbuck, waterbuck, lechwe and puku and, in particular, need to form linkages between the protected areas.

At first sight it might seem impossible to reverse any of the settlement and cattle grazing practices which are in place. The only way in which the situation might be altered would be through the formation of a joint stakeholder association whose objective was to improve floodplain management (**Fig. 3 – Social Objective**). This **co-management institution** would include parks, conservancies and other communal land in the focal areas and its *raison d'être* would be to improve land use in the floodplains in order to achieve the higher valued land uses which wildlife management can offer.

A vital part of this co-management institution must be a circumscribed rôle for government – it will not work if local stakeholders feel they are being co-opted by government to fulfil some conservation objective which is in the State's interests. For the institution to be effective there must be a common appreciation by all stakeholders that there is a valid case for attempting to improve floodplain conservation and that it is within the stakeholders' powers to take and implement decisions which will bring about the changes.

A five year project has been developed which would establish such an institution and provide the funds for it to implement decisions (**Fig. 4**). The budget also provides funds for the **Ecological Objective** of introducing wetland grazer species to parks, conservancies and other land; limiting fire and illegal hunting and monitoring the status of species populations and their habitats.

Although the original conception of this project was focussed on the conservation of wetland grazer populations, it has become apparent that the funds invested would enhance the overall land use values of the Caprivi to the extent that the project funding could be repaid from the increased returns from land within 5 years. The project is financially viable.

Collaboration with the Botswana wildlife authorities is a key component of this Plan. Linkages need to be maintained with the larger Botswana wetland grazer populations and, with innovative projects in the vicinity of the international boundary, the potential exists for both Botswana and Namibia to bring about rapid improvements in these species populations.

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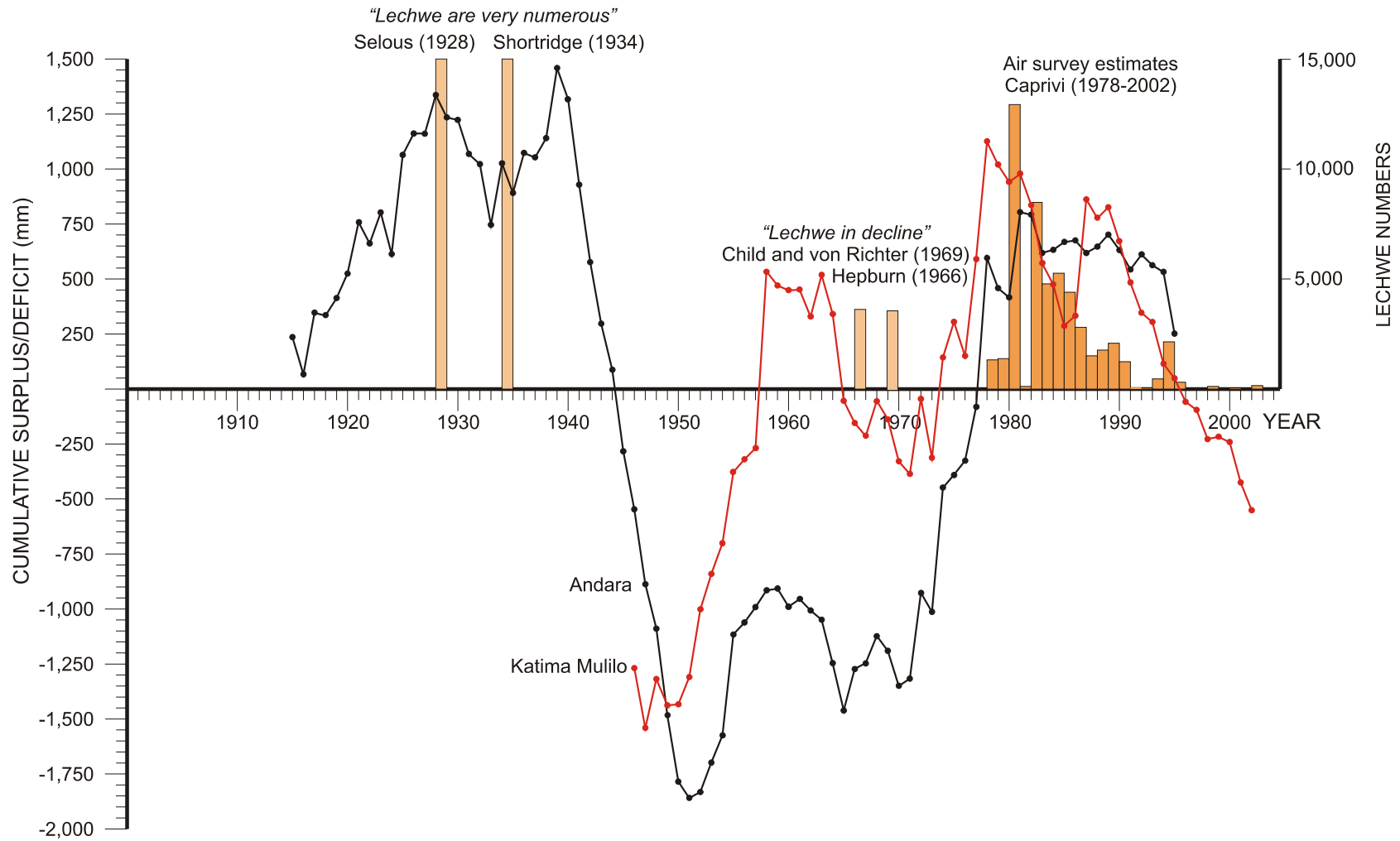
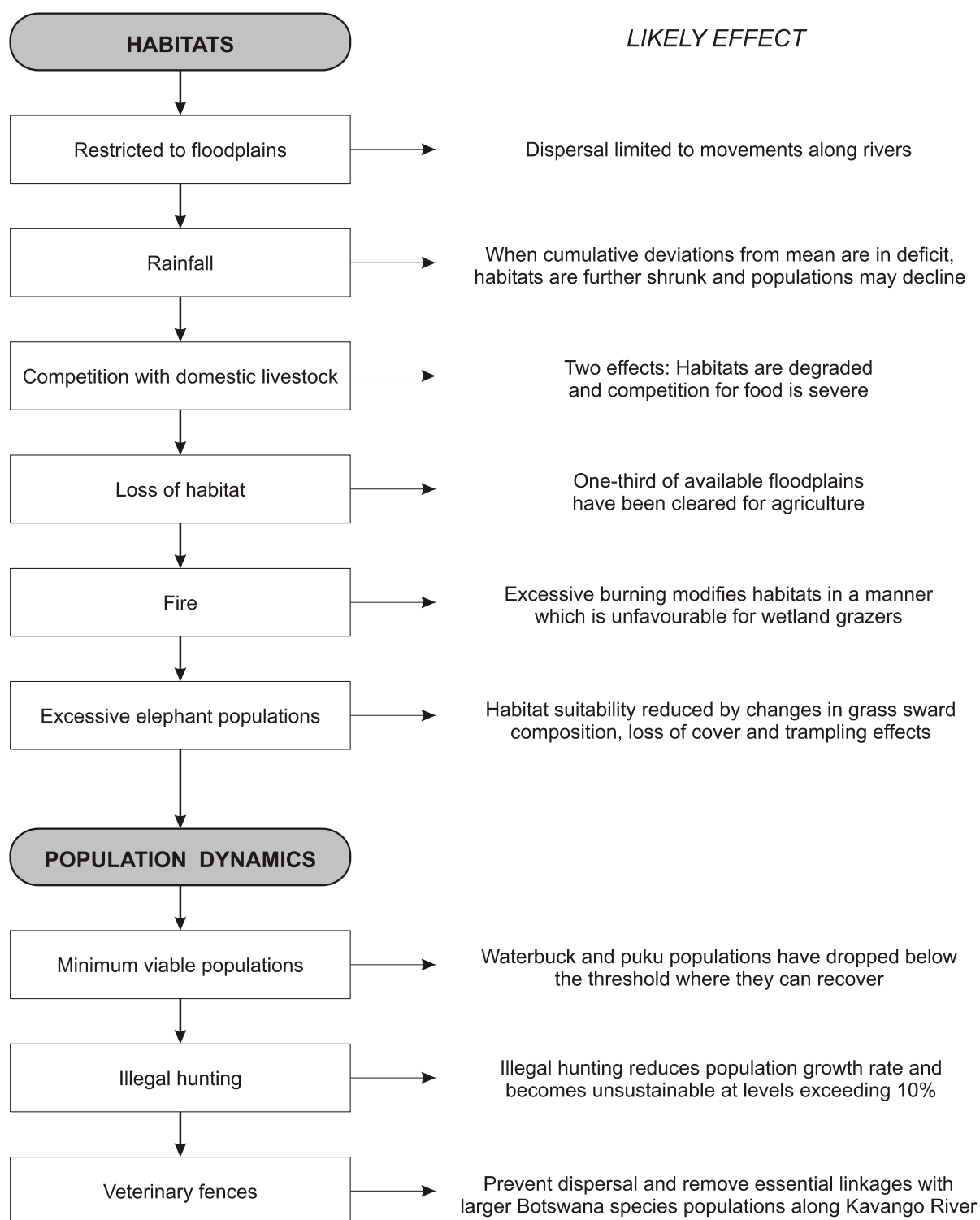


Figure 1: Long term rainfall (cumulative deviations from the mean) in the Caprivi and Red Lechwe numbers

## HIERARCHY OF FACTORS LIMITING POPULATIONS



**Figure 2:** Limiting factors affecting reedbuck, waterbuck, lechwe and puku populations



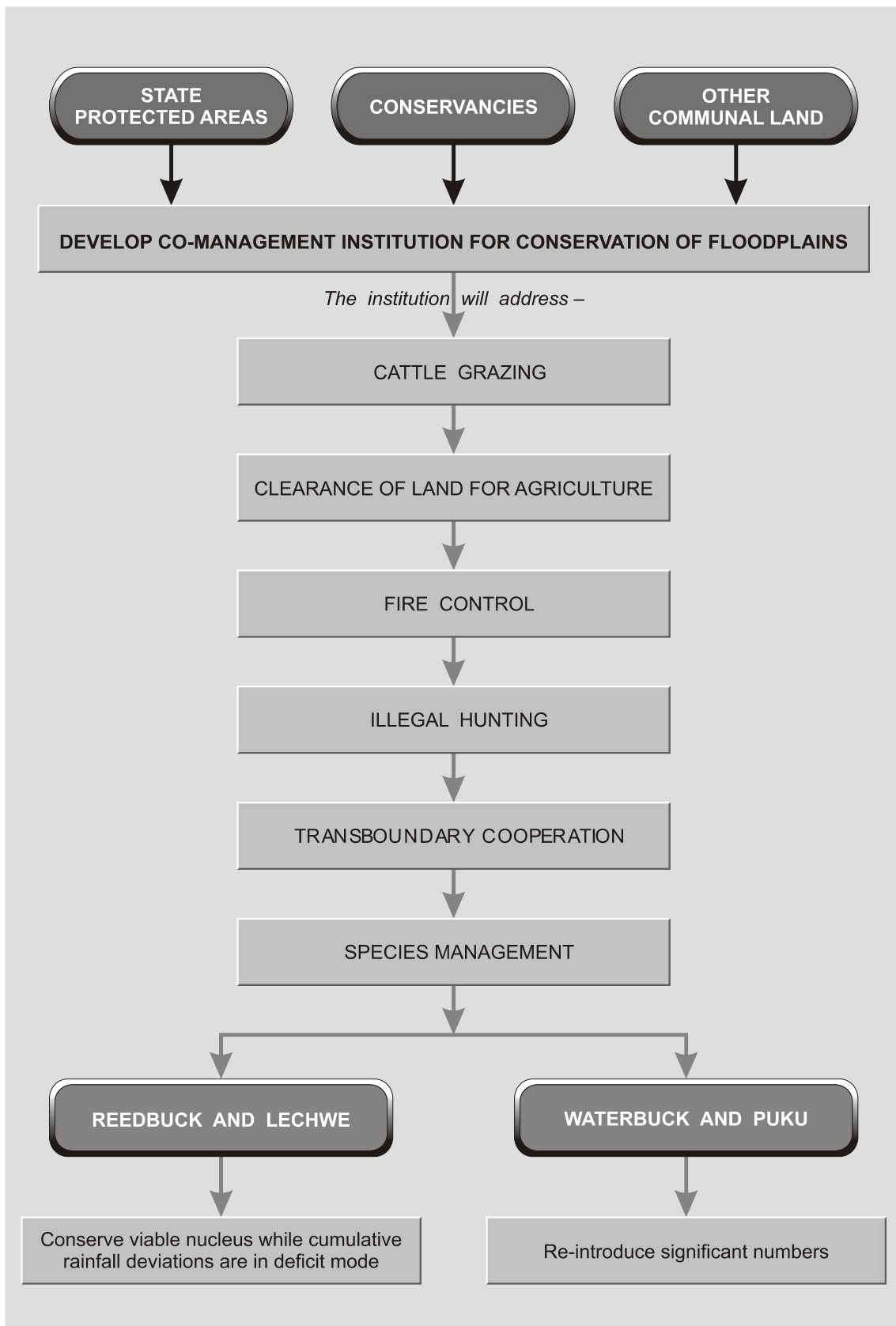


Figure 3: Strategy for enhancing reedbuck, waterbuck, lechwe and puku populations

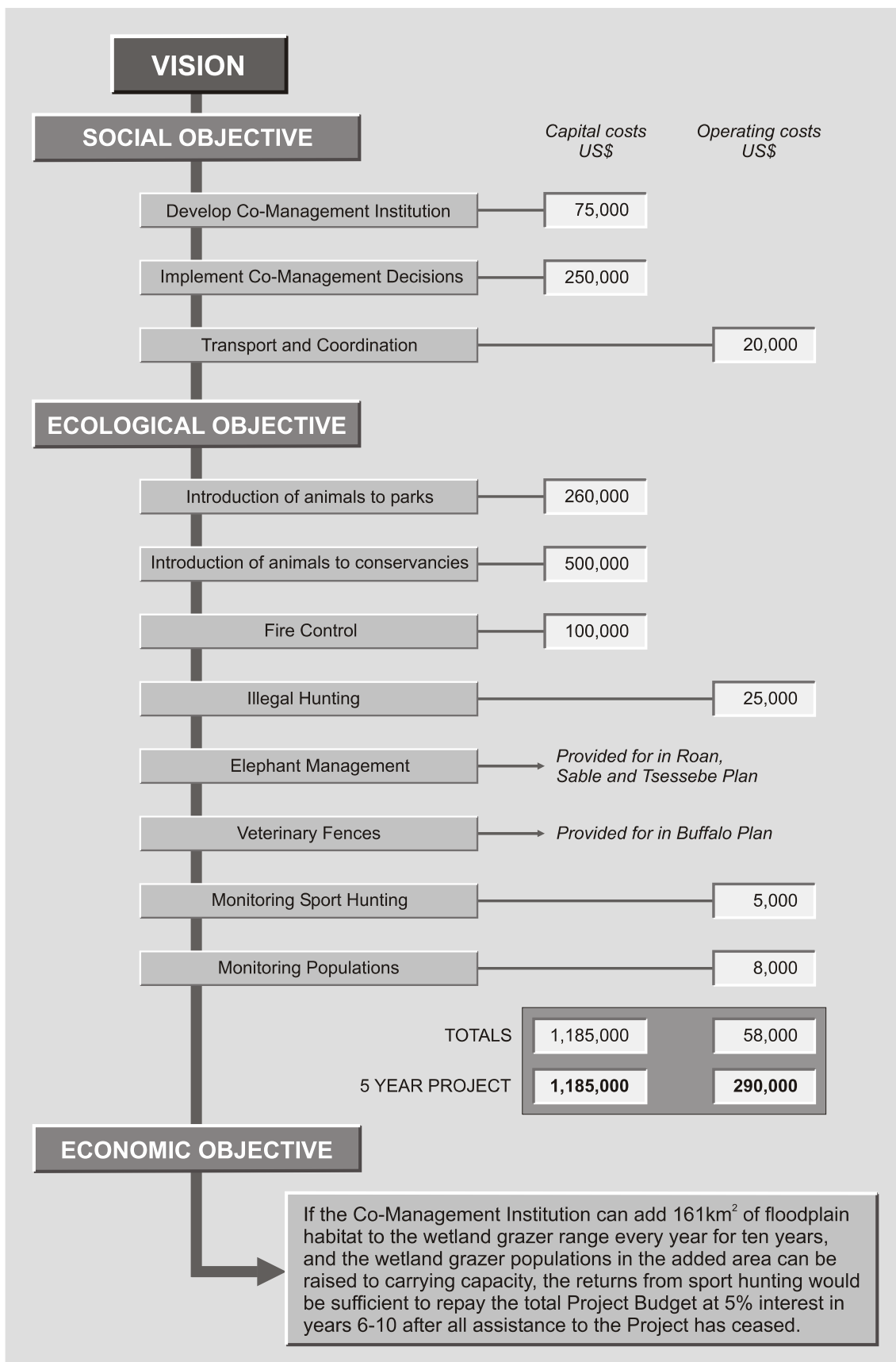


Figure 4: Financial requirements for the Wetland Grazers Management Plan

## INTRODUCTION & BACKGROUND

This **Species Management Plan** should be read in conjunction with the **Species Report for Reedbuck, Waterbuck, Lechwe and Puku** prepared under the **Transboundary Mammal Project** of the Ministry of Environment and Tourism in January 2004.

### Conservation Status and Significance

The taxonomy of Macdonald (2001) has been used in this study. The Wetland Grazers are in the **Tribe** REDUNCINI (antelopes of wetlands and tall or tussock grassland) of the **Subfamily** HIPPOTRAGINAE (the grazing antelopes) in the **Family** BOVIDAE (bovids) which is in the **Suborder** RUMINANTIA (ruminants) of the mammalian **Order** ARTIODACTYLA (even-toed ungulates). This background study includes four species –

- Southern Reedbuck – *Redunca arundinum* (Boddaert 1785) subspecies *R.a. arundinum*
- Common Waterbuck – *Kobus ellipsiprymnus* (Ogilby 1833), subspecies *K.e. ellipsiprymnus*
- Red Lechwe – *Kobus leche* (Gray 1850), subspecies *K.l. leche*
- Puku – *Kobus vardoni* (Livingstone 1857)

The distribution of the four species in Southern Africa is shown in **Map 1**. In the IUCN Red Data Book (Hilton-Taylor 2000), all four species are classified as Lower Risk (Conservation Dependent): they are not threatened at the global, continental or regional level. All four species are of conservation concern at the national level in Namibia because their ‘natural range’ is limited to the Caprivi, their numbers are low (far lower than in the recent past), they appear to be declining and some of the subpopulations making up the national metapopulation are isolated from one another. However, because reedbuck, waterbuck, lechwe and puku in the Caprivi are spatially linked to larger populations in Botswana, they would not qualify independently for any category of threat based on population numbers.

The strongest arguments for enhancing the wetland grazer populations is that these are the species specifically adapted to the floodplain habitats of the Caprivi. When present in substantial numbers they establish the unique character of the area. If they were to disappear from the only area in Namibia where both rainfall conditions and habitats are favourable, this would be a loss of biological diversity and a failure of wildlife management. **Their persistence in viable numbers can be seen as an indicator of ecosystem health.**

The wetland grazers are effectively ‘chained’ to the floodplain habitats of the Caprivi – some 4,500km<sup>2</sup> (**Map 2**). These same habitats are the prime choice for agriculture and cattle grazing and it is apparent that the wetland grazers are engaged in an unequal competition for resources. Mendelsohn and Roberts (1997, page 18) list the areas cleared for agriculture in the floodplain habitats – in 1996, this amounted to some 21% of the wetlands. As of 2004, the proportion has probably risen to about 28% (Martin 2004, page 16). Of the remaining 3,000km<sup>2</sup> of floodplain habitats in the Caprivi, only about 500km<sup>2</sup> is found within State Protected Areas.

To achieve the aims of this management plan requires the conservation of the wetland habitats in the Caprivi. It may require the development of radical new co-management institutions to achieve this.

## Populations

Air surveys in the Caprivi date back to 1978 and most parts of the species' range have been surveyed at least once in every 3 years. Because of a lack of consistency in the survey methods, the data do not permit a detailed evaluation of population trends. Estimates for the four species (from the *Background Study*) are shown in the table below, together with the highest estimates obtained in the past 25 years. Noting that all four species are likely to be underestimated on air surveys and that this effect will be most pronounced in the case of reedbuck and puku, the estimates given below are likely to be a minimum number.

In any situation where the numbers of a species are lower than we might wish them to be, it is as well to have a perspective of how much greater they might be. Using an average density of 2/km<sup>2</sup> for reedbuck, waterbuck and puku and a density of 20/km<sup>2</sup> for lechwe, the potential populations in State Protected Areas are as shown below. Surveys of the four species in recent years indicate that all populations have decreased to a fraction of their former numbers and that there is justification for a major conservation effort to enhance them.

	REEDBUCK	WATERBUCK	LECHWE	PUKU
Caprivi – Present populations	100	25	200	Not recorded
<i>Highest estimate</i>	<i>250</i>	<i>150</i>	<i>13,000</i>	<i>Uncertain</i>
<i>Year</i>	<i>(1980)</i>	<i>(1994)</i>	<i>(1980)</i>	
Commercial Farms	Uncertain	3500	200	None
<b>2004 TOTAL</b>	<b>200 ?</b>	<b>3750</b>	<b>400</b>	<b>Uncertain</b>
Potential populations in Parks	1000	1000	10000	1000
Botswana (ULG 1995)	2000	1000	70000	<100

The location of waterbuck and lechwe populations on private land is shown on **Maps 3 & 4**. Although substantial populations of these species have been built up, it would be a mistake to regard these as secure because of their permanent vulnerability to rainfall regimes.

## Limiting Factors and Threats

Rainfall appears to be the primary limiting factor for reedbuck, waterbuck, lechwe and puku populations. The species' historic range in Namibia was limited to the Caprivi (and slightly to the west of the Caprivi) where the annual rainfall is over 500mm. A more subtle rainfall influence is likely to be affecting all four species in their floodplain habitats. Dunham and Robertson (2001) demonstrated that the cumulative surpluses and deficits of the deviations from the mean rainfall correlate closely with the performance of tsessebe populations in Kruger National Park. The data from the Caprivi suggest that this effect is also influencing the wetland grazers (**Fig.1**).

The long term surplus or deficit in rainfall could be the main determinant of the carrying capacity of the floodplains in the Caprivi (**Map 2**). The floodplain vegetation types mapped by Mendlesohn and Roberts (1997) will vary in their potential to support populations of wetland grazers depending on the moisture in the soil and the extent of surface water. Lechwe are likely to suffer the most from this factor. However, the carrying capacity for all four species is likely to fluctuate in synchrony with the long term rainfall regime.

If, as it seems, this long term rainfall regime is significant in regulating the wetland grazer populations, then there is little that can be done to assist the species in their natural range. The best strategy would be to protect a small nucleus of the animals so that when the rainfall moves once more into a surplus mode, the population can begin to increase.

The limiting factors for reedbuck, waterbuck, lechwe and puku can be arranged in a hierarchy –

- (1) When it occurs, **a deficit in the accumulated rainfall is likely to be the primary limiting factor** for reedbuck, waterbuck, lechwe and puku populations. All management efforts directed at secondary factors are unlikely to surmount this fundamentally negative effect. A surplus in the accumulated rainfall need not necessarily produce a linear increase in population growth rates – it should rather be seen as the removal of a primary limiting factor.
- (2) **Competition with cattle and habitat degradation** caused by cattle effectively render 2,500km<sup>2</sup> of floodplain habitat in the Caprivi unsuitable for the wetland grazers. The 500km<sup>2</sup> of floodplains in the State Protected Areas has limited potential to develop substantial populations of reedbuck, waterbuck, lechwe and puku.
- (3) Floodplain habitats are being reduced throughout the Caprivi by **clearing fields for crops**. More than one-quarter of the original wetland grazer habitat has been cleared to date.
- (4) **Fire further reduces the potential** of the floodplains to support populations of the wetland grazers, particularly reedbuck. Over 60% of the Caprivi is burnt every year.
- (5) **The excessive elephant populations** in the Caprivi and Botswana are affecting the floodplain habitats by removing essential cover required by reedbuck, by causing structural changes in grasslands through trampling effects and by direct competition for grazing.
- (6) The numbers of waterbuck and puku have fallen below **minimum viable populations**. Even if conditions were highly favourable for these species, it is doubtful whether they would be able to recover.

- 
- (7) **Illegal hunting** may be a factor in preventing these species populations from increasing.
- (8) **Veterinary fences** are a limiting factor in their influence on movements of reedbuck, waterbuck, lechwe and puku between Botswana and the Caprivi along the Kavango River

These limiting factors are summarised in **Fig.2** on page (viii). The most important implication of the *Background Study* is that the major management emphasis must lie in conserving and recovering the floodplain habitats for the wetland grazers.

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## Background and Rationale for the Management Plan

Under the present Namibian environmental legislation, management plans are required for species which are rare or valuable and which share boundaries with neighbouring countries. Reedbuck, waterbuck, lechwe and puku are rare (within their 'natural' range) and valuable. If the Caprivi floodplains were teeming with thousands of lechwe and hundreds of reedbuck, waterbuck and puku, the spectacle would attract tourists and provide a financial return which greatly exceeds that possible from alternative land uses. In a less important way, all four species would contribute to the income from sport hunting in the Caprivi and, in the case of lechwe, there is potential for significant harvests of meat and hides.

The costs of restoring wild species populations which are in low numbers can be extremely high and the history of conservation is littered with examples of funds which have been spent but failed to achieve their objective. The aim of this management plan is to provide a sharp focus on measures likely to enhance reedbuck, waterbuck, lechwe and puku populations and, conversely, to emphasize areas in which it is not worth wasting conservation funds.

Because of the dependency of reedbuck, waterbuck, lechwe and puku populations on rainfall, there will be long periods during which, despite the best management performance, little can be done to increase species numbers. The plan relies on a combination of maintaining viable breeding nuclei when the long term rainfall regime is in a deficit mode and enabling species populations to respond rapidly when environmental conditions are favourable.

The plan has no relationship to standard government five-year budgeting plans – except insofar as the required operational expenditure for State Protected Areas needs to be maintained continuously above the minimum threshold needed for effective management and law enforcement. The achievement of greater numbers over the available range is subject to many factors being favourable – including success in conservancy development, a reversal of the present spread of unplanned settlement and land clearance, mitigation of the effects of veterinary fences and management of elephant.

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## Plan Structure

The management plan for reedbuck, waterbuck, lechwe and puku requires a process-based structure –

- (1) The plan begins with a **VISION** statement which incorporates three objectives – a **SOCIAL OBJECTIVE**, an **ECOLOGICAL OBJECTIVE** and an **ECONOMIC OBJECTIVE**.<sup>1</sup> The Vision is hopefully consistent with Namibian policy and legislation and the Species Management Plan should have public and political support.
- (2) To realise the **VISION**, the **SOCIAL OBJECTIVE** needs to be addressed first.
- (3) It is overwhelmingly apparent that the key issue affecting reedbuck, waterbuck, lechwe and puku populations (**Fig. 2** and **Map 2**) is the status of the floodplain habitats. Moreover, the limited amount of floodplain habitat within State Protected Areas in the Caprivi is less than optimum for the development of significant species populations of the wetland grazers.
- (4) To achieve any meaningful progress in conserving floodplain habitats outside the State Protected Areas will require the development of a co-management institution involving the State, conservancies and other communal land. In other words, the social requirement is a prerequisite for achieving the ecological objective.
- (5) The **ECOLOGICAL** and **ECONOMIC OBJECTIVE** will start to be realised once progress is being made with the Social Objective.

In a process-based approach, the constraints are addressed serially. The institutional decisions required under the strategy have priority over any management activities. The budgetary requirements for implementing the plan are approximate at this stage.

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1. The concept of a **GOAL** for the plan has been avoided since it implies some fixed endpoint to be achieved. This plan is seen as ongoing and aimed at continuous enhancement of reedbuck, waterbuck, lechwe and puku populations.

## **MANAGEMENT PLAN**

### **VISION AND OBJECTIVES**

AWARE that **reedbuck, waterbuck, lechwe and puku** once occurred widely in the Caprivi;  
REGARDING these antelope as highly desirable species to be conserved as part of the biological diversity and essential character of the Caprivi;  
NOTING the economic contribution which these species can make as a part of wildlife-based land use in the Caprivi;  
NOTING also that present populations of these species are in low numbers caused largely by the loss of floodplain habitats in the Caprivi;  
RECOGNISING that there is a need to address floodplain conservation as an issue affecting all stakeholders in the Caprivi;

Accordingly, the **OBJECTIVES** of this Management Plan are –

#### **SOCIAL OBJECTIVE**

**To develop a CO-MANAGEMENT INSTITUTION in the Caprivi for the conservation and management of wetland habitats.**

#### **ECOLOGICAL OBJECTIVE**

**To increase REEDBUCK, WATERBUCK, LECHWE and PUKU numbers in the Caprivi through the recovery of original floodplain habitats.**

#### **ECONOMIC OBJECTIVE**

**To realise the full potential of REEDBUCK, WATERBUCK, LECHWE and PUKU as components of wildlife-based land use for the benefit of rural landholders and the State, according to the provisions for sustainable use in Namibia's Constitution.**

The strategy which follows the Vision Statement is shown in **Fig. 3**, page (ix).

### **1. Social Objective**

The floodplains of the Caprivi are in high demand for agriculture and cattle grazing. The geographic nature of the Caprivi is such that the largest area of floodplain habitat is between the Zambezi and Chobe rivers – which is also the most heavily settled part of the Caprivi. There are also floodplains along the Kwando, Linyanti and Kavango rivers. At first sight it might seem impossible to reverse any of the settlement and cattle grazing practices which are in place.



The only way in which the situation might be altered would be through the formation of a joint stakeholder association whose objective was to improve floodplain management (**Fig. 3**). This co-management institution might have to begin in limited way with partnerships between Mamili and Mudumu national parks, the neighbouring conservancies (Wuparo, Mashi, Mayuni, and Kwandu) and those portions of communal land which are not conservancies but border onto the Kwando River. The State's interest would be to preserve a continuous belt of floodplain along the Kwando River ensuring that the wetland grazer populations in Mamili, Mudumu and the 'Golden Triangle' are not isolated. This might be followed with linkages through the communal land to Salambala conservancy.

Typical measures which would be addressed under co-management might be some form of zoning along rivers to preserve portions of the original floodplain, restricted areas for cattle grazing or seasonal use of grazing, fire control and illegal hunting. A vital part of this co-management institution must be a circumscribed rôle for government – it will not work if local stakeholders feel they are being co-opted by government to fulfil some conservation objective which is in the State's interests. For the institution to be effective there must be a common appreciation by all stakeholders that there is a valid case for attempting to improve floodplain conservation and that it is within the stakeholders' powers to take and implement decisions which will bring about the changes (Ruitenbeek and Cartier 2001).

## 2. Ecological Objective

The ecological objective of restoring and recovering wetland habitats will depend on success with the social objective.

Population numbers of each of the four species may ultimately be determined by the long term cumulative surpluses and deficits in the annual deviations from the mean rainfall – in which case little can be done to enhance population sizes when the rainfall regime is in a deficit mode. The best strategy for all four species in these circumstances may be to ensure that a viable breeding nucleus survives the negative conditions and is able to rebound when the cumulative rainfall moves into a surplus mode.

In the case of reedbuck and lechwe, there are probably such viable breeding nuclei in place at the moment. In the case of waterbuck and puku, there are definitely not. The numbers of these species may have dropped below minimum viable populations and there are strong arguments for re-establishing breeding nuclei.

**It is recommended that breeding nuclei of both waterbuck and puku are established on the Kavango River in Mahango national park and on the Kwando River in Mamili national park.** About 50 animals of each species should be introduced in each locality according to the procedures detailed in the *Background Study* (pages 46-47).

Depending on progress in developing a functioning co-management institution (the SOCIAL OBJECTIVE), it would be a valid use of donor funds to establish breeding nuclei in some of the conservancies. This would provide the incentives for floodplain management and give validity to the concept of co-management. A key aspect of such introductions is that they should be spatially linked to the wetland grazer populations in the State protected areas.

Some factors which may enhance reedbuck, waterbuck, lechwe and puku populations when the rainfall regime is in a cumulative surplus mode are listed below and they include consideration of the required management actions and monitoring. Although this section has been placed under the ECOLOGICAL OBJECTIVE, some of the items should be seen as belonging on the agenda for the co-management institution.

- (1) Fire: At present more than 60% of the Caprivi is burnt each year (Mendelsohn and Roberts 1997) and the floodplains seem to be a prime target for this practice. Of the four wetland grazer species, reedbuck are the most adversely affected by fire since it destroys their essential habitat requirement – tall grass cover – forcing them to relocate. There is no evidence that waterbuck, lechwe and puku are attracted to burnt areas and it is more likely that fire exerts a negative influence through the destruction of their preferred food plants.

The conventional techniques for controlling fire – a network of firebreaks and adequate manpower and equipment to put out fires – seem somewhat pointless when it is a local traditional practice to initiate fires. The best hope of modifying the current situation may lie in placing the problem squarely in the lap of a co-management institution.

Satellite imagery can be used for detailed fire mapping (Mendelsohn & Roberts 1997, p 24-25) although this monitoring technique is expensive if the progressive incidence of fires over the dry season is to be mapped. A single image of the final result of fires by the end of November each year may be adequate.

- (2) Illegal hunting: Under normal rainfall conditions, reedbuck, waterbuck, lechwe and puku populations can be expected to increase at more than 10% per annum and, accordingly, the populations can sustain illegal offtakes of about 10% annually before their effective growth rate becomes zero (*Background study*, page 48). If illegal hunting can be limited to about 2-3% per annum, populations will maintain growth rates of over 7% and be able to sustain reasonable sport hunting quotas.

In the previous management plans in this series (Martin 2002b & 2003b), the manpower and budgetary requirements for effective law enforcement over the full area of parks have been presented. The situation for the wetland grazers is somewhat different. Since all four species are limited to floodplain habitats and since the total area of floodplains in State protected areas is only about 500km<sup>2</sup>, existing human resources ought to be able to provide adequate protection. But the objective of this management plan is not simply to protect the wetland habitats in parks – it is to make a greater area of floodplain habitat available to reedbuck, waterbuck, lechwe and puku. This is only likely to be achieved through a genuine co-management arrangement which addresses illegal hunting through a coordinated approach amongst all stakeholders.

Law enforcement effort and illegal activity needs to be monitored to ensure that the objective for illegal hunting is being achieved. The present monitoring systems which are in place in the conservancies are adequate for this purpose.

- (3) Elephants: The large elephant population in the Caprivi and northern Botswana (over 100,000 animals) may be responsible for fundamental structural changes to the habitats of reedbuck, waterbuck, lechwe and puku. The loss of cover and trampling effects are likely to alter the grass sward in a manner which is not favourable for these species.

There have been no population reductions of elephant either in northern Botswana or the Caprivi as part of ecosystem management in recent times (if ever). Any decision to reduce elephant populations, even if it is limited and experimental, will require **public and political support** and **transboundary cooperation** with Botswana.

- (4) Veterinary fences: The veterinary fence along the international boundary between Namibia and Botswana in the extreme north-western corner of Botswana impedes the movement of the wetland grazers along the Kavango River and reduces the likelihood of establishing viable populations of reedbuck in Khaudum national park and Nyae Nyae conservancy. Discussions are needed with the veterinary authorities in Namibia and Botswana with the aim of mitigating the effects of this fence.

- (5) Legal hunting: Reedbuck, waterbuck, lechwe and puku populations all respond similarly to the offtake of sport hunting trophies. The annual recruitment to the part of the age pyramid from which males are hunted is low – about 3% of the population. Thus, in order to retain sufficient prime breeding males, **sport hunting quotas for reedbuck, waterbuck, lechwe and puku should not exceed 3% of the total population.**

- (6) Population numbers: Progress towards realising the ECOLOGICAL OBJECTIVE of this management plan relies on a knowledge of the trends in reedbuck, waterbuck, lechwe and puku population numbers. If considerable effort is to be put into increasing numbers of these species, then it would be desirable to measure the effects of this investment. The limitations of present aerial survey methods when applied to estimating reedbuck, waterbuck, lechwe and puku populations are discussed in the *Background Study* (page 26) and alternative options involving road strip counts, line transects and low level air surveys are presented on pages 51-52 of the *Background Study*.

These options should be seen as supplementary to standardised annual air surveys (Craig 2000). The recommendation made in the *Management Plan for Roan, Sable and Tsessebe* that **Botswana and Namibia collaborate on annual air surveys** to achieve a regular coverage of the Caprivi should still be pursued.

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### 3. Economic Objective

This objective (page 6) should be progressively achieved as the ecological objective is met. There is no particular end-point for the objective – the greater the numbers of reedbuck, waterbuck, lechwe and puku in the Caprivi, the greater will be the economic benefits which can be derived from the species through hunting and non-hunting tourism.

#### Expected Results

The economic objective implies some notional concept of the financial value which reedbuck, waterbuck, lechwe and puku could bring to land use if their numbers were close to carrying capacity. It is difficult to attribute some marginal increment to the increase in non-hunting tourism which might result from substantial populations of these species and it will not be attempted here. Suffice it to say that tourism is presently low in the Caprivi and an abundance of these species would be likely to make a significant difference. This is particularly so because they would be highly visible in the prime game-viewing habitats – the floodplains – and would establish the unique character of the Caprivi.

An estimate of the difference which an abundance of the wetland grazers would make to the sport hunting industry was not attempted in the *Background Study* (because it was not expected that it would be significant). However, using the tables in Appendix 2 of the *Species Report for Buffalo*, two scenarios were examined briefly for this Management Plan – one with no wetland grazers being available for hunting and one with lechwe, waterbuck and reedbuck present at densities of 20/km<sup>2</sup>, 2/km<sup>2</sup> and 2/km<sup>2</sup> respectively in the floodplain habitats. These densities were then adjusted in the proportion which the floodplain habitats comprise of the total park areas (about 25% excluding West Caprivi Game Reserve). Whilst the contribution of waterbuck and reedbuck trophies is not significant, the quota which becomes available for lechwe makes a substantial difference to the safari hunting industry, raising the total value of the trophy fees by some 35% and the net return from hunting as a land use by 40% (i.e. from US\$7.37/ha to US\$10.29/ha). These figures were derived on the assumption that buffalo numbers were at carrying capacity (1.5/km<sup>2</sup>): using present buffalo densities (0.25/km<sup>2</sup>), the impact of the lechwe quota is even greater.

The above exercise is theoretical and applies mainly to the State protected areas. However, it has relevance to land outside the State protected areas: the original floodplain area in the Caprivi is slightly less than 25% of the total area of the Caprivi so that the figure calculated for net land use value can be extrapolated beyond the parks. For every 1,000km<sup>2</sup> of communal land, the annual potential earnings under a hunting system with species populations at carrying capacity is of the order of US\$1 million – provided that the floodplains are an integral part of the wildlife system. As long as people in communal lands (including conservancies) use their floodplain areas for planting crops and grazing cattle, returns of this magnitude will be denied to them.

### Management Activities

Given that the ecological objective is being achieved and reedbuck, waterbuck, lechwe and puku populations are increasing at the expected rate towards carrying capacity, the actions needed to maximise the income for the primary stakeholders are as follows –

- (1) Hunting quotas need to be set in the manner described in the *Background Study* (page 49).
- (2) All tourism concessions and safari hunting concessions should be sold to maximum advantage. The best system for hunting on State land is one of public auction because it is difficult for any corrupt practices to affect the competitive outcome and prices are usually higher than those obtained through a tender system. Tenders are the next best option but, unless the system for award of tenders is transparent, corruption is frequently encountered.
- (3) Where conservancies or other communal lands abut onto State Protected Areas and a functioning co-management institution has been established, there may be a need to set quotas for the entire range as opposed to individual areas. This is particularly relevant to species such as lechwe whose dispersal tends to be along rivers. The co-management relationship between the State and its neighbours should enable the overall proceeds from hunting to be shared when the hunting is taking place from a common population.
- (4) There is a transboundary aspect to this same problem. In several instances it is clear that hunting trophies are coming from a population shared between Botswana and Namibia.<sup>2</sup> This is a test case for developing workable transboundary institutions which, in the first instance, result in cooperation on quota setting and, ultimately, lead to income sharing.<sup>3</sup>

### Impacts

The impact of achieving the highest valued land use is likely to be considerable. It will provide the revenue for effective State conservation, elevate the standard of living for landholders with reedbuck, waterbuck, lechwe and puku in the Caprivi and create the incentives for more land to be put under wildlife. Ultimately, it could revolutionise land use practices and pave the way for transfrontier conservation areas.

### Monitoring

The annual record of revenues and incomes earned from safari hunting in State Protected Areas, conservancies and other communal land in the Caprivi will provide the information needed to assess progress towards achieving the economic objective. It will be necessary to separate out from the data the portion of the income attributable to reedbuck, waterbuck, lechwe and puku.

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2. Child and von Richter (1969) document the annual transboundary movement of lechwe as coinciding with flooding. Numbers of lechwe on the Botswana side of the Chobe River reached a peak in December-January and the entire population was in the Caprivi from March-June of each year.
  3. In the Kasane Workshop, the opportunity to develop such an institution involving Salambala Conservancy in Namibia and the Chobe Enclave community in Botswana was identified. These communities are directly opposite one another on the Chobe River and are almost certainly hunting from the same populations.

## **RISKS AND ASSUMPTIONS**

This management plan differs from the plans for buffalo and for roan, sable and tsessebe in that it introduces a SOCIAL OBJECTIVE. In both of the earlier plans it was recommended that the State seek partnerships with its neighbours in the Caprivi in order to manage wildlife at the appropriate scale. What has become apparent in this study is that unless co-management of the wetland habitats is achieved, the prospects for reedbuck, waterbuck, lechwe and puku are limited. There is about 3,000km<sup>2</sup> of floodplain habitat in the Caprivi of which only 500km<sup>2</sup> lies in State protected areas. And this 500km<sup>2</sup> is split into 4 isolated portions, the largest of which is Mamili national park at 280km<sup>2</sup> (*Background Study*, Table 6).

### **Assumptions**

- (1) The highest valued uses for semi-arid savannas are those derived from land under wildlife and the additional values conferred by viable populations of reedbuck, waterbuck, lechwe and puku are significant enough to warrant a substantial investment and conservation effort.
- (2) Adequate funding will be available to the Directorate of Parks and Wildlife through the fiscus to maintain its essential functions in State Protected Areas and, in particular, to protect the floodplain habitats which support reedbuck, waterbuck, lechwe and puku populations.
- (3) MET and its supporting agencies will be successful in establishing a co-management institution for floodplains in the Caprivi amongst the legitimate stakeholders which will expand the potential range for reedbuck, waterbuck, lechwe and puku beyond State protected areas, create linkages between State protected areas and improve the security of existing populations.
- (4) There are no fundamental ecological obstacles to the introduction of waterbuck and puku into floodplain habitats in the Caprivi.

### **Risks**

- (1) That the variability of rainfall could result in long periods of cumulative deficits which prejudice the performance of populations of reedbuck, waterbuck, lechwe and puku.
  - (2) That local communities cannot be persuaded that it is in their interests to enter into a co-management scheme to conserve the Caprivi wetlands.
  - (3) That government, being accustomed to a central leadership rôle, will find it difficult to enter into a genuine co-management arrangement where it is not the dominant partner.
  - (4) That, despite best efforts, illegal hunting pressures originating from within and outside the Caprivi may not be contained.
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## **FINANCE AND CAPACITY**

A detailed budget for the operating and capital costs associated with this plan has been developed in ANNEX 1 and a summary of the budget figures relating to each management requirement is shown in Fig. 4 on page (x). The 'project' should run for five years.

The key points arising from this budget are –

- (1) It is assumed that this project would be submitted to donors and the budget and project viability calculations are designed to this end. There is, of course, nothing to prevent the Namibian Government from funding it.
- (2) Where provision has been made for any particular activity in the budget of a previous management plan (*Southern Savanna Buffalo 2002, Roan, Sable and Tsessebe 2003*), reference is made to the provision and the cost is not duplicated in this plan.
- (3) The major part of the budget is intended to be devolved upon the co-management institution which is recommended to be formed. The budget could be administered by the Ministry of Environment and Tourism initially but as the co-management institution gains strength it would be better for its relationship to be directly with donors. The Ministry would be represented on the co-management institution by the Directorate of Parks and Wildlife.
- (4) Much of the funding is of a contingency nature because it is impossible to predict in advance the nature of the decisions which might be arrived at by the co-management institution – however, it is vital that funding is available to back up whatever measures are decided upon. It is likely that the capital provisions provided to support decisions will be drawn down irregularly over the 5 year project.
- (5) A substantial part of the capital costs in the budget are intended for the re-introduction of wetland grazer species where populations have fallen below minimum viable populations. It might be possible to reduce some of the costs significantly if the transactions are done on a government-to-government basis – using the argument that it is consistent with the spirit of establishing a transfrontier conservation area..
- (6) This species management plan was embarked upon because of a genuine conservation concern for the wetland grazers and, in a sense, economic considerations were secondary. Nevertheless, there is need for a reality check on any proposed costs which greatly exceed resources available from the Ministry of Environment and Tourism.

The highest value arising from the recovery of floodplain habitats and the enhancement of reedbuck, waterbuck, lechwe and puku populations is likely to lie in non-consumptive uses. The potential for increasing tourism, particularly in the larger regional setting of a transfrontier conservation area, is considerable. But even without this, the project appears very viable based solely on the added value which the recovery of wetland grazer populations would bring to the sport hunting industry.

An exercise has been carried out in Annex 1 which demonstrates that the entire set of capital and running costs could be borrowed from a bank at a standard rate of interest and the loan would be acquitted within ten years of inception of the plan – provided that the co-management institution can add about 160km<sup>2</sup> of floodplain habitat annually to the present amount of floodplain habitats in protected areas, and that reedbuck, waterbuck, lechwe and puku populations can be raised to carrying capacity in the expanded areas.

- (7) Considerable emphasis is placed on monitoring in the financial provisions of the plan. This includes the central task of estimating numbers of reedbuck, waterbuck, lechwe and puku; habitat assessment including monitoring of land use and the effects of elephants on floodplain habitats; monitoring illegal hunting; fire mapping and setting of sustainable hunting quotas.
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## **TRANS-BOUNDARY COOPERATION**

An examination of the list of management activities in **Fig. 3** shows that most of the areas identified for potential co-operation and collaboration between Botswana and Namibia at the Kasane Workshop repeat themselves in this Management Plan –

- (1) Maintaining linkages between species subpopulations;
- (2) Ensuring compatible forms of land use on either side of the international boundary;
- (3) Expanding the available range for reedbuck, waterbuck, lechwe and puku;
- (4) Co-operating on law enforcement directed at illegal hunting;
- (5) Managing the interaction between reedbuck, waterbuck, lechwe and puku and other species – particularly elephants;
- (6) Controlling fire;
- (7) Collaborating on air surveys to improve population estimates;
- (8) Collaborating in setting hunting quotas and monitoring the sustainability of hunting;
- (9) Maintaining liaison between wildlife departments and communities managing wildlife on either side of the international border.

Over and above these considerations, some very specific new issues arise in this management plan. Namibia needs to introduce a significant number of animals to its existing wetland grazer populations to improve their viability. Sourcing these animals from Botswana presents an opportunity for tangible collaboration.

The Transboundary Mammal Project provides scope for imaginative local projects. Along the international boundary separating Botswana and Namibia are a number of suitable areas involving both State Protected areas and local communities in which new populations of reedbuck, waterbuck, lechwe and puku could be established – possibly using founder stock from areas further inland in northern Botswana.<sup>4</sup> One method of achieving rapid growth from small groups of reedbuck, waterbuck, lechwe and puku may be to locate them in interim holding paddocks of 10-50km<sup>2</sup> where the effects of predation, habitat modification by elephants and competition with other grazing species are minimised – which would enable these starting cohorts to increase rapidly. The paddocks might straddle the international boundary thus providing a genuine foundation for transboundary co-operation in initiating a ‘seed-bank’ for rare species production which will be used to populate larger areas.

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4. Botswana would not be in a position to provide puku since their own population is dangerously low. However, this may present a further opportunity: together, Botswana and Namibia could introduce puku from Zambia and enhance both of their populations.

## **IMPLEMENTATION PROCESS & UPDATE PROCEDURES**

### **Timing and Duration of Plan**

Implementation of this plan should commence as soon as possible because all of the species populations involved are dangerously low. A five year project, suitable for donor funding, has been designed to achieve the objectives of the Plan. After 5 years, the need for outside funding should disappear but the proposed co-management institution for conservation of floodplain habitats would be permanent.

From the outset, an adaptive management monitoring programme should underpin the implementation of the Plan and test the underlying hypotheses regarding reedbuck, waterbuck, lechwe and puku population growth rates and carrying capacities. The objectives, hypotheses and management activities in the plan should be modified as needed to take into account externalities which may arise (and almost certainly will arise) during implementation.

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The first draft of the Species Management Plan was completed in February 2004 and it is intended to present it to the joint forum between Botswana and Namibia 1st March 2004.

Review of the draft plan should take place during March-April 2004 and, following comments and decisions from the Directorate of Parks and Wildlife and the Directorate of Scientific Services in the Ministry of Environment and Tourism, a second draft should be prepared for submission to the Ministry by June 2004. Subject to any further revisions which might arise from inter-ministerial discussions or transboundary liaison with Botswana, a Final Plan should be ready for adoption before the end of the year.

This should be followed by a meeting between the Ministry of Environment and Tourism and supporting agencies to discuss implementation and, in particular, the approach to funding.

Central to the success of the Plan is the establishment of a Co-management Committee which will take decisions on an ongoing basis using available monitoring information. Notwithstanding any modifications made as and when necessary during implementation, there should be a mandatory review of the plan every two years – preferably synchronised with the results from the air surveys provided for in the schedule of activities. In the course of such reviews, if any major changes are needed in the plan, the document should be modified, updated and re-approved.

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**ANNEX 1**

**BUDGET**

Costs are developed below following the structure of the Management Plan. It is assumed that the major part of the budget would devolve upon the new co-management institution of which the floodplains in the protected areas would be part. This budget could be administered under the Ministry of Environment and Tourism initially but as the co-management institution gains strength it would be vital for its relationship to be directly with donors (assuming that this will become a donor funded project). The Ministry would be represented on the co-management institution by the Directorate of Parks and Wildlife. The remainder of the budget would be taken up by the Ministry of Environment and Tourism for the activities of the Directorate of Parks and Wildlife and the Directorate of Scientific Services. Any portion of this budget could be taken up by another government department or by an NGO, if it is considered that the particular management activity might best be carried out by a supporting agency. The provision for developing a co-management institution might best be devolved upon an ‘independent broker’ (which may be an NGO or an individual) with high credibility with local communities in the Caprivi.

The project is for five years and all costs are in United States dollars.

**1. SOCIAL OBJECTIVE**

(1) Development of co-management institution

To develop a co-management institution may require the full-time services of a skilled social scientist for at least one year. The amount provided is intended to include on-site accommodation in the Caprivi and living expenses –

*Capital provision* ..... 75,000

(2) Implementation of co-management decisions

Should it arise out of the co-management decisions that there is a need for relocation of existing settlements, compensation for affected families or loss of grazing, development of new infrastructure including boreholes to provide drinking water for people or domestic livestock, it would be as well to have a capital provision available to meet such costs. The amount provided is notional.

*Capital provision* ..... 250,000

(3) Transport and coordination costs

The main operating costs will lie in transport. Provision is made for a vehicle for the social scientist (capital cost of \$25,000 depreciated over 5 years = \$5,000/year) and mileage (25,000km per year @ \$0.2 per km = \$5,000). This vehicle will also ferry people to meetings. An arbitrary provision is made for coordination costs (\$10,000).

Annual recurrent expenditure ..... US\$20,000

**2. ECOLOGICAL OBJECTIVE**

(1) Introduction of waterbuck and puku to State Protected Areas

Provision is made for the introduction of 100 waterbuck (\$1,000 per captured animal = \$100,000). Logically, they should come from private land in Namibia where the total population exceeds 3,500 animals and transport costs would be the lowest. However, in the event that this is not possible, provision is made for the animals to come from South Africa (100 animals split into 4 loads of 25/load @ \$1.4/km x 1,200km ≈ \$7,000).

Puku should come from Zambia where there are estimated to be over 20,000. The cost per captured animal should be about US\$500 and the distance from Kafue to the Caprivi is about 500km (100 animals @ \$500 = \$50,000 + transport 4 x 500km @ \$1.4/km ≈ \$3,000).

For both species, costs will arise at the release sites, including holding bomas, pre-release bomas, supplementary feeding, transport between bomas and veterinary services. An additional amount of \$100,000 is provided for this.

*Capital provision* ..... \$260,000

(2) Introduction of wetland grazers to conservancies

In the event that a successful co-management institution is established and floodplain habitats are secured outside the parks, introductions of reedbuck, waterbuck, lechwe and puku to conservancies (or other communal land) should accelerate recovery of Caprivi populations. This would probably take place in the second year of the project and this part of the budget would devolve to the co-management institution.

The provision for waterbuck and puku would be the same as for (1) above. An additional \$240,000 is provided for the introduction of reedbuck and lechwe.<sup>5</sup>

*Capital provision* ..... \$500,000

(3) Fire control

It is hoped that the co-management institution will come up with solutions to the present high level of fire incidence – more through local ‘policy changes’ than through conventional fire protection techniques. However, there may be a need for funds to support co-management decisions on measures to reduce the fire problem. An arbitrary provision is made for \$100,000 which would devolve to the co-management institution if justified.

*Capital provision* ..... \$100,000

Detailed provisions were made in the *Buffalo Management Plan* for improved fire control and fire monitoring in the protected areas of the Caprivi.<sup>6</sup> Once the co-management institution is functioning, Parks would be able to draw down on the co-management resources to increase protection on the floodplains in protected areas.

- 5. Both of these species might be sourced from Botswana and, under the collaborative forum using government-to-government contact, the costs might be considerably reduced.
- 6. The capital provision for firebreak preparation was \$100,000 and the annual recurrent expenditure for firebreak maintenance, fire-fighting and monitoring was \$36,000.

(4) Illegal hunting

The required manpower and budgets for law enforcement in the State Protected Areas were developed in the *Management Plan for Roan, Sable and Tsessebe*<sup>7</sup> and are therefore not included here. A provision was also made to assist conservancies with training in law enforcement (\$20,000). Both of these provisions included a component for monitoring law enforcement effort and levels of illegal activity.

By making law enforcement part of the agenda for the co-management institution, it is expected that innovative measures will be found to reduce illegal hunting in the floodplains. The provision made here is to support any such measures which may arise from decisions made by the co-management institution without specifying in advance what these might be.

Recurrent expenditure ..... \$25,000

(5) Elephants

In the *Management Plans for Buffalo* and for *Roan, Sable and Tsessebe* provisions were made for research experiments to be carried out in a limited locality where the impact of elephant on the preferred habitats of these species is reduced by removing elephants. The outcome would be compared with a ‘control’ area where there is no elephant management. These experiments could be expanded to include the effects of elephant on reedbuck, waterbuck, lechwe and puku at no additional cost.

(6) Veterinary Fences

A significant provision for liaison, coordination and collaboration both with the Namibian Directorate of Veterinary Services and the Botswana Department of Animal Health and Production was made in the *Buffalo Management Plan* and no additional provisions are required in this Plan.

(7) Monitoring Sport Hunting

A small provision is needed to ensure that monitoring of trophies is incorporated into all sport hunting of reedbuck, waterbuck, lechwe and puku populations. This work should be carried out under the auspices of the co-management institution, with data collection being done by parks staff and local communities. Some contractual assistance may be need to co-ordinate the methodology, assist with data analysis and present annual results. Provision is made for 10 days of a local consultant’s time and includes an allowance for travel, data compilation and writing up the results.

Recurrent expenditure ..... US\$5,000

7. The provision was: Capital expenditure – \$100,000; Recurrent expenditure – \$170,000.

(8) Monitoring Population Numbers

There is a special requirement for monitoring numbers of reedbuck, waterbuck, lechwe and puku in the floodplains. Several options were presented in the *Background Study* (pages 51-52) and the option which is costed here is that using a Supercub to fly low-level transects across the floodplains perpendicular to the line of the river. It does not preclude the use of the funds for an alternative option.

At a sampling intensity of 50%, 1,500km<sup>2</sup> would require to be surveyed and, at a cost of US\$5/km<sup>2</sup> actually surveyed, the total cost would be US\$7,500. The cost includes the analysis of data and reporting.

Recurrent expenditure (rounded) ..... \$8,000

A table summarising these costs appears on the next page

**PROJECT VIABILITY**

In the long term, the highest economic returns attributable to the wetland grazers are likely to come from an expanding eco-tourism industry in the Caprivi. It would be totally speculative to attempt to calculate this value. In the short term it is possible to estimate the area of floodplain habitat which would have to be recovered annually in order that the returns from sport hunting of the wetland grazer species at carrying capacity would meet the financial outlay of the project (US\$1.5 million over 5 years).

Under full development of a sport hunting regime involving all the larger wildlife species, the marginal increase in income which is attributable to reedbuck, waterbuck and lechwe, from wildlife areas in which floodplains comprise 25% of the total wildlife area and these species are at carrying capacity in those floodplains, is around US\$3/ha (Economic Objective, page 10). Thus, for every square kilometre of floodplain habitat under wildlife management to which an additional 3km<sup>2</sup> of non-floodplain habitat can be added, the marginal increment which this project will bring about is US\$300/km<sup>2</sup>.

At full development, the existing State protected areas (500km<sup>2</sup> of floodplains) would therefore earn an additional net US\$150,000 annually (over and above whatever they are earning at present). The project annual recurrent expenditure is US\$58,000 (see Summary Table on the next page) and this would be required every year with or without the project. Thus if the wetland grazer populations in the State protected areas could be brought to carrying capacity, they could meet the running costs of a co-management institution for floodplain conservation 2½ times over.

The estimated capital required for this project is US\$1.2 million. Treating this as a bank loan at 5% compound interest to be repaid over 10 years with 5 years grace, and including the annual running costs in the debt, the annual instalments which would be required in years 6-10 (i.e. after the donor inputs have ceased), are as shown in the table on the next page. It is assumed that wetland grazer populations would be at carrying capacity after 5 years. Repayments are linked to the amount of floodplain habitat which should be added annually to the initial area of floodplains in the State protected areas. On a linear basis, if the co-management institution is capable of adding 161km<sup>2</sup> each year to the initial amount of floodplains habitat, the original ‘debt’ of the donor outlay can be acquitted within 5 years.

The full set of costs for the Management plan are tabulated below. Budget items shown in blue font would be taken up by the co-management institution when it is successfully established. All other budget items would devolve upon the Ministry of Environment and Tourism.

### Budget Requirements for the Wetland Grazers Management Plan

All costs are in United States dollars

	Annual Operating Costs	Capital Costs
<b>SOCIAL OBJECTIVE</b>		
(1) Development of co-management institution		75,000
(2) Implementation of co-management decisions		250,000
(3) Transport and coordination	20,000	
<b>ECOLOGICAL OBJECTIVE</b>		
(1) Introduction of waterbuck and puku to parks		260,000
(2) Introduction of wetland grazers to conservancies (Year 2)		500,000
(3) Fire control		100,000
(4) Illegal hunting	25,000	
(5) Elephant management – <i>provided for in RST plan</i>	–	
(6) Veterinary fences – <i>provided for in Buffalo plan</i>	–	
(7) Monitoring sport hunting	5,000	
(8) Monitoring population numbers	8,000	
<b>TOTALS . . . . . US\$</b>	<b>58,000</b>	<b>1,185,000</b>
<b>FIVE-YEAR PROJECT TOTALS . . . . . US\$</b>	<b>290,000</b>	<b>1,185,000</b>
<b>CAPITAL + RECURRENT EXPENDITURE . . . . . US\$</b>		<b>1,475,000</b>

### Project Viability

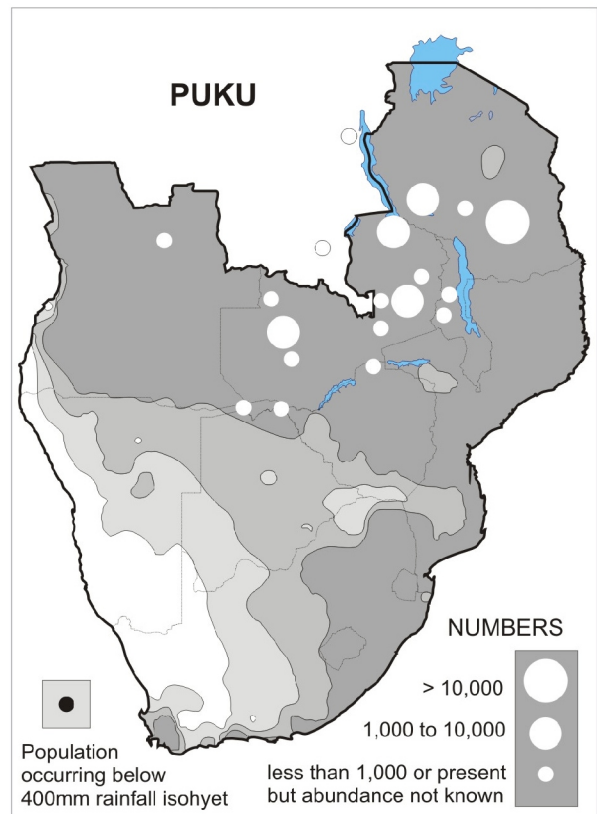
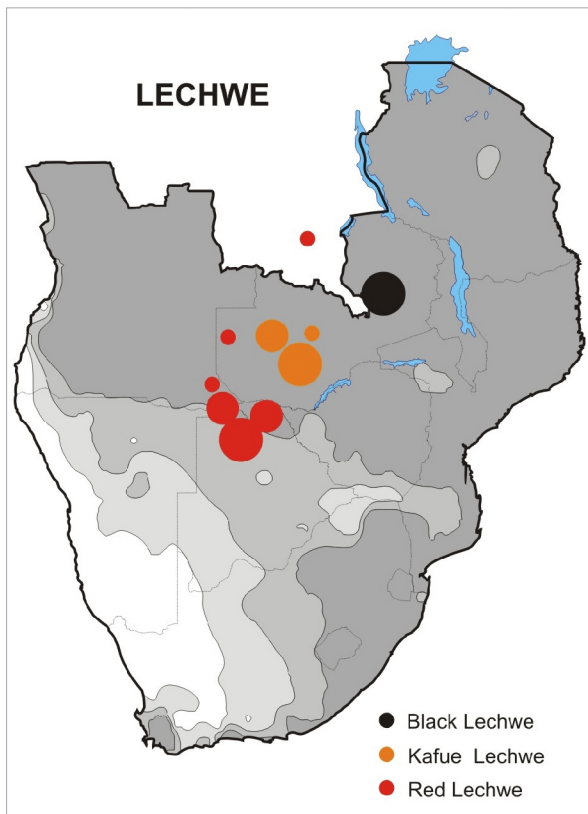
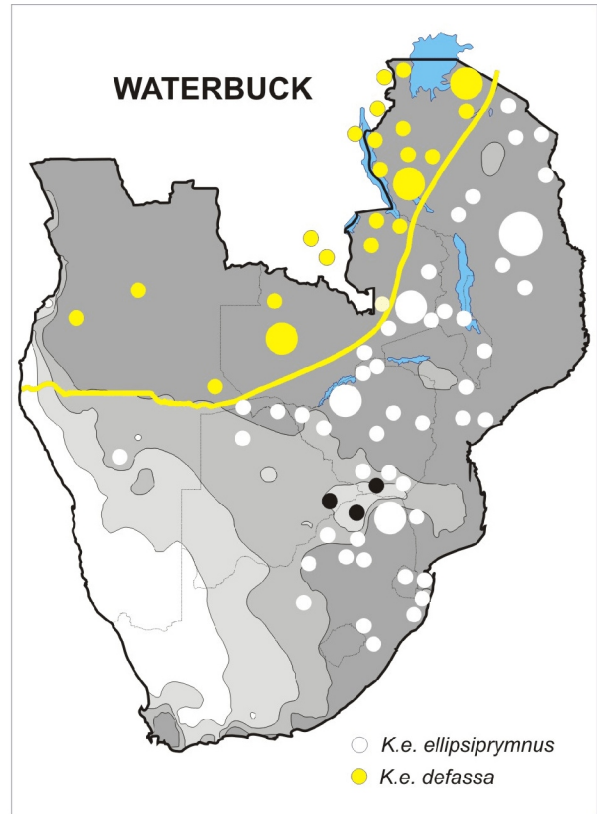
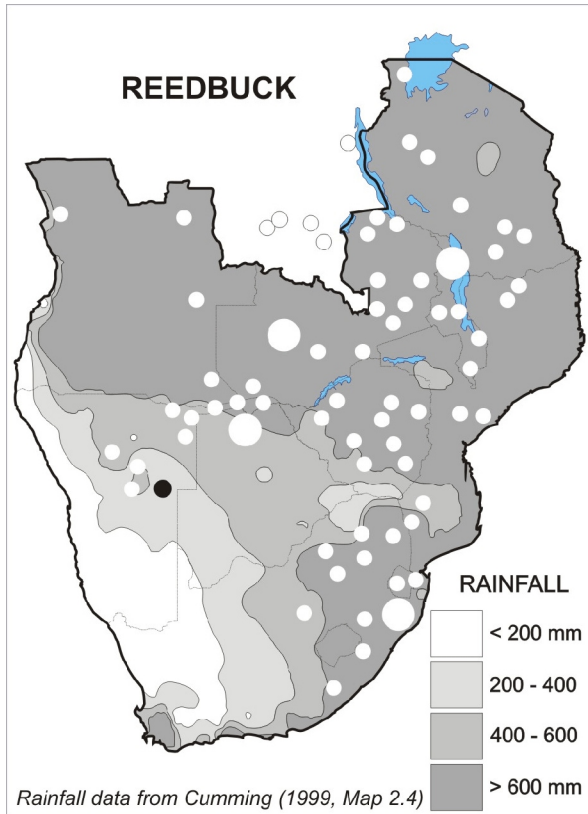
Year	Recurrent cost	Capital outlay	Total	Cumulative Total	Interest	Debt	Floodplain area	Payments
1	58,000	100,000	158,000	158,000	7,900	165,900	500	0
2	58,000	200,000	258,000	423,900	21,195	445,095	661	0
3	58,000	400,000	458,000	903,095	45,155	948,250	821	0
4	58,000	300,000	358,000	1,306,250	65,312	1,371,562	982	0
5	58,000	200,000	258,000	1,629,562	81,478	1,711,040	1,142	0
6	58,000		58,000	1,426,317	71,316	1,497,633	1,303	342,723
7	58,000		58,000	1,164,729	58,236	1,222,966	1,464	390,904
8	58,000		58,000	841,881	42,094	883,976	1,624	439,084
9	58,000		58,000	454,710	22,736	477,446	1,785	487,265
10	58,000		58,000	0	0	0	1,945	535,446

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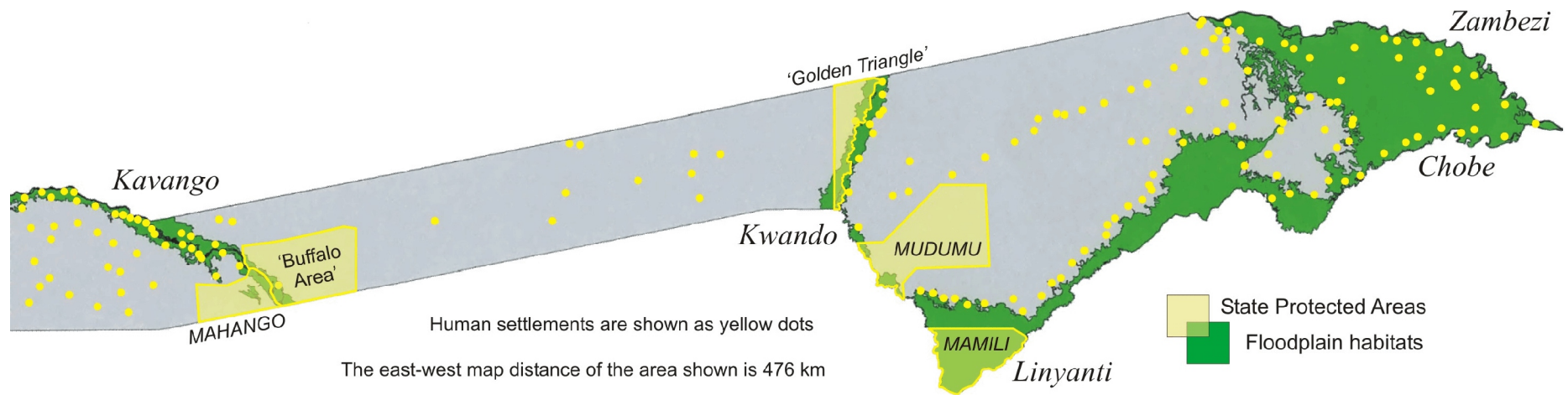


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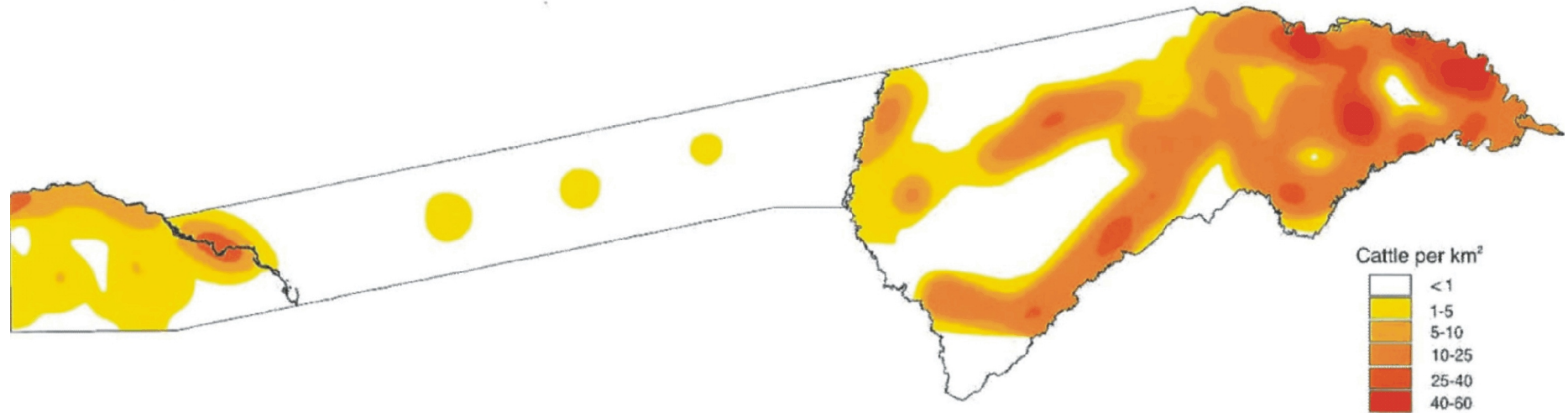


Population data from ASG (1998)

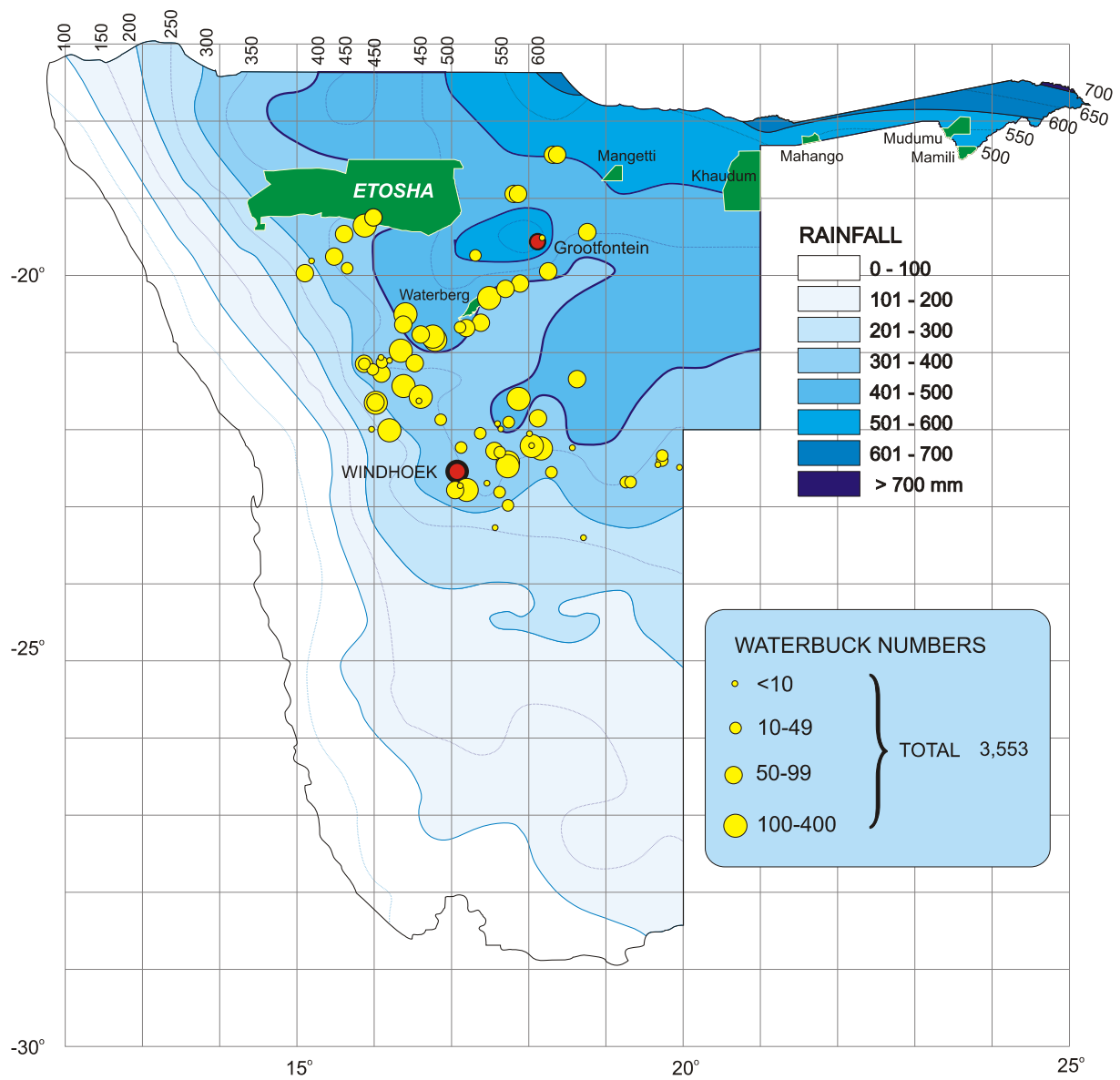
**Map 1: Distribution of Reedbuck, Waterbuck, Lechwe and Puku in Southern Africa**



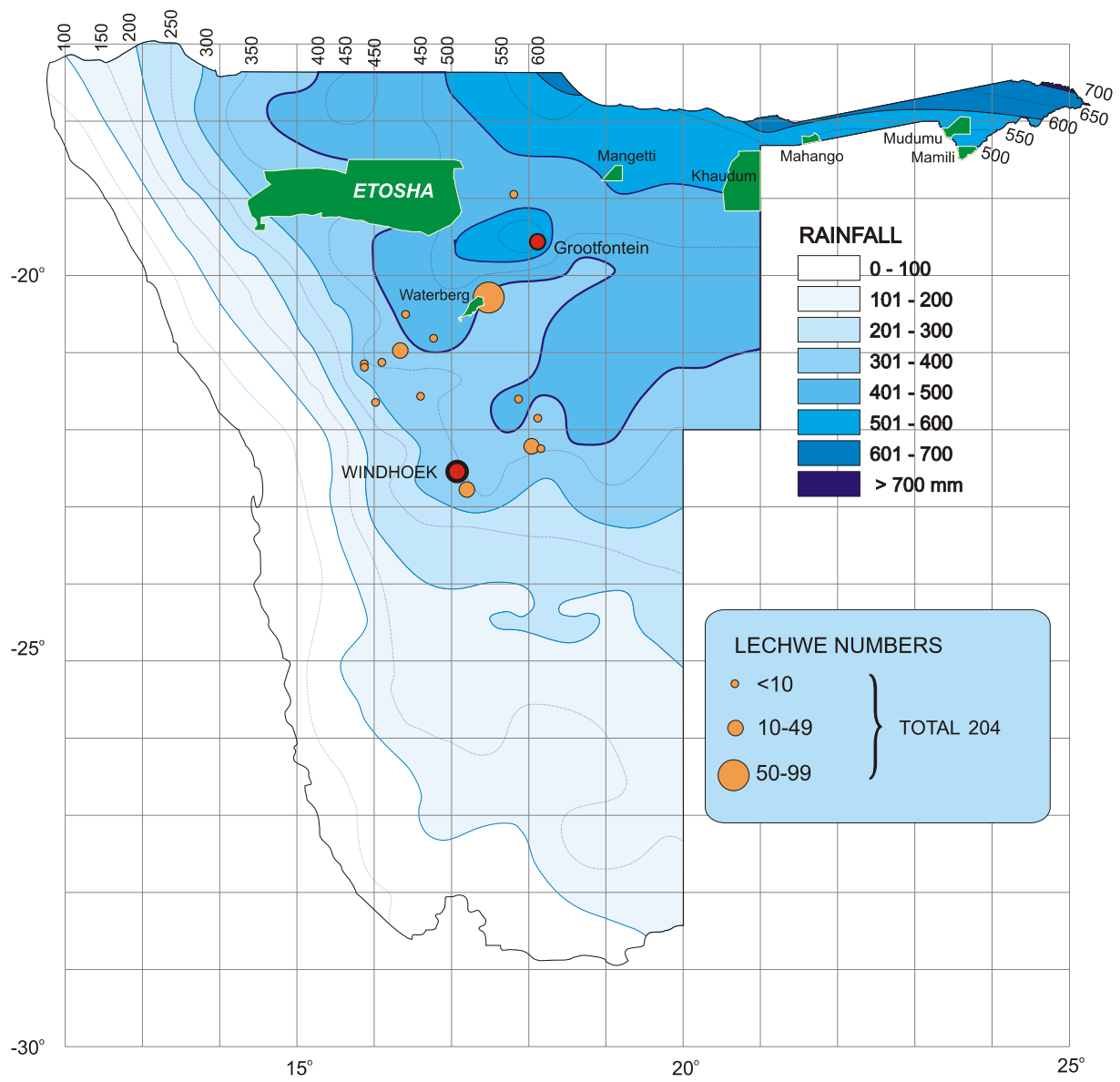
Both maps are adapted from *An Environmental Profile and Atlas of Caprivi* (Mendelsohn and Roberts 1997)



**Map 2: Floodplain habitats, State Protected Areas and Cattle grazing pressure in the Caprivi**



**Map 3: Waterbuck on Private Land in Namibia**



**Map 4: Lechwe on Private Land in Namibia**