Project Proposal

THE ROLE OF WATER AVAILABILITY AND CHEMICAL WATER QUALITY FOR PLAINS UNGULATES IN THE ETOSHA NATIONAL PARK

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1 INTRODUCTION

As one of the game-richest National Parks of Namibia, the Etosha National Park (ENP) is of extraordinary value for Namibia's economy through tourism. Furthermore it plays a vital role for the realization of long-term plans of the Namibian government to sustainably utilize the wildlife of the Park. 'Buffer zones' along the boundaries of the ENP might be established after Zimbabwe's example, in which sustainable quotes of game can be utilized by local people inhabiting the bordering areas. Besides that, newly proclaimed as well as existing game reserves might be restocked with game from Etosha. The ENP is the only source of large numbers of game for the restocking of other areas in Namibia.

One of the main requirements for the realization of these plans are healthy and abundant game populations in the ENP. Since the late sixties, however, Etosha's plains ungulate populations (Burchell's zebra, blue wildebeest, springbok and gemsbok) are declining. The reasons are currently being researched by the research section of the Etosha Ecological Institute (EEI), Ministry of Wildlife and Tourism, so that it may be halted and reversed. *Predation, Disease, Food* and *Water* are considered as potentially limiting factors to the ungulates of the ENP. The factor *Water* is currently studied by the project executant in its components *chemical water quality* and *water availability*. During the year 1995 the study was supported by the European Union, and most of the fieldwork was completed.

Water availability plays an important role for the utilization of potential grazing areas by wildlife. During the rainy season the moisture of forage plants and rain water puddles provide the game

with water. In the dry season, however, when plants become drier and seasonal waterholes dry out, it is more difficult for game to fulfil their water requirements. The animals are then concentrating their grazing and social activities around perennial waterholes (Berry 1980). During this time areas even with good quality forage but without open water cannot be utilized by water-dependent animal species and stay underutilized. On the other hand, too few waterholes and an uneven distribution of perennial waterholes can lead to vegetation degradation and soil erosion in the vicinity of these waterholes.

Besides water availability the *chemical quality of water* is considered to be of importance within the ecosystem. A previous study of the project executant (Auer 1993, Auer in press) about chemical water quality at waterholes in the ENP revealed major spacial and temporal variabilities of ion concentrations in the water. Thereafter, the drinking animal is supplied with different amounts of ions at different waterholes as well as at different times of the year. This must have implications on the mineral balance of the animal.

At several waterholes the mean concentrations of several ions occur above the guidelines given by the Department of Water Affairs, Namibia (1991) for stockwatering. These guidelines are currently also serving as guidelines for game due to a lack of more detailed information. The influence of highly mineralized water on the utilization of waterholes by game and on the physiology and reproduction of game has so far only been studied fragmentarily (Child, Parris & Le Riche 1971; Knight, Knight-Eloff & Bornmann 1988; Knight 1991).

On the one hand physiologically based, species-related guidelines for the chemical quality of water provided to wildlife are missing. On the other hand the exact limits of ion concentrations, above which the utilization by game is decreasing drastically, are not known. However, the knowledge of 'acceptance limits' of individual game species towards chemical water quality could be very useful. By improving the chemical water quality of underutilized waterholes just above a certain 'acceptance limit', these waterholes could be made attractive to game again. In this way saline water could be utilized by game, taking pressure from fresh water waterholes and reducing the risk of overutilization of the vegetation and soil erosion around these favoured waterholes. An appropriate water quality management programme could therefore be very valuable to the Management of the Etosha National Park as well as for other National Parks, game farms and future conservancies in which waterholes rich in ions occur.

2 OBJECTIVES

The main aims of the study are

2.1. to investigate and compare the provision of water and the need of waterhole numbers and distribution as well as of chemical water qualities, and to identify discrepancies between the actual situation and the requirements in the ENP. Together with the Park Management recommendations for changing critical water provision and water quality situations will be thought out and actions will be taken to implement optimum conditions.

2.2. to provide useful information on water provision and water quality management for farms, conservancies and National Parks outside the ENP.

3 ACTIVITIES

The following steps are undertaken:

3.1. Investigation of the water provision situation at waterholes and the moisture content of forage plant species throughout the year

via

a) the investigation of number and distribution of available water bodies for game in rainy and dry season.

b) monitoring changes of water availability at selected waterholes throughout the year.

c) regular measurements of the plant moisture content of plant species utilized by the studied ungulate species blue wildebeest (Connochaetes taurinus), Burchell's zebra (Equus burchelli), springbok (Antidorcas marsupialis) and gemsbok (Oryx gazella). (in cooperation with the plant ecologist W.P. du Plessis, EEI).

3.2. Investigation of water provision requirements (number and distribution of waterholes) of ungulates (in cooperation with the plant ecologist W.P. du Plessis)

by

a) identifying underutilized and overutilized areas and investigating the responsible factors (food and/or water availability?).

b) investigating the daily maximum distances which the ungulates species travel from waterholes taking the food availability in the vicinity of waterholes into account.

c) studying the drinking frequency of different ungulate species and comparing it with the moisture content of the utilized forage plant species.

d) monitoring seasonal migrations of ungulates and investigating the responsible factors (food and/or water availability?).

3.3. Examination of the chemical qualities of water at waterholes within the Etosha National Park and their temporal variabilities throughout the year

via

a) entire chemical analyses of water from waterholes in the ENP at the Department of Water Affairs, Windhoek.

b) measurements of the electric conductivity of water as a quick measure to indicate the total amount of dissolved solids (Auer 1993, Gammer 1993, Hem 1982).

3.4. Identification of waterholes that are underutilized because of their chemical water qualities

a) by comparing the number of animals that drink during a 12-hour-period at pairs of neighbouring waterholes with contrasting chemical water qualities (one moderately saline waterhole - one highly saline waterhole).

b) by undertaking 12-hour-counts at various other waterholes.

3.5. Identification of 'acceptance limits' of game for chemical water qualities

by

a) observing the drinking behaviour of animals, i.e. of the ungulate species, during 12-hour-observations at two neighbouring waterholes with contrasting chemical water qualities (one moderately saline waterhole - one highly saline waterhole).

b) monitoring the reaction of game on gradual (step-by-step) changes (improvement and deterioration) of chemical water quality. The methodology and logistics still have to be discussed in detail with the Park Management.

3.6. Examination of correlations between the mineral content of utilized plant species and the chemical water quality (individual ion concentrations) of the utilized waterholes

via

a) chemical analyses of the utilized plant species (in cooperation with the plant ecologist W.P. du Plessis, EEI).

b) chemical analyses of water from the utilized waterholes.

3.7. Identification of areas within the Park with critical water provision

by analysing the data collected under points 1. and 2.

3.8. Identification of waterholes, which are underutilized as a result of poor chemical water quality

by analysing the data collected under points 3. until 6.

3.9. Modelling and testing of low-cost solutions for the Park Management to improve problematic water quality and availability situations

by considering the results achieved from points 1. until 8. (in cooperation with the staff of the Park Management) .

3.10. Modelling of optimum water provision and water quality situations for the study area

by considering the results achieved from points 1. until 8. (in cooperation with the staff of the Park Management).

3.11. Recommendations for waterhole management in similiar areas within and outside the ENP

by resuming the results achieved from points 1. until 10.

4 STUDY PERIOD

The duration of the study will approximately be three years, the time frame will be 1.1.1995 until 31.12.1997. After a period of one-and-a-half years of data collection, the analyses of data and the

documentation of the results will follow. This study might become subject of a Ph. D. thesis of the project executant.

5 PROGRESS OF THE STUDY UP TO NOW

During 1.1.1995 until 31.12.1995 the study was financially supported by the European Commission in Windhoek (Delegation of the Commission of the European Communities). Due to budgetary reasons, however, the European Commission cannot support this study further next year.

During the year 1995 data were collected according to activity points 1. until 6.. At the beginning of 1996 first data analyses will be carried out in order to produce a final report after the first year of the study for the European Community.

6 FUTURE OF THE STUDY

In 1996 data collection will be taken further only where it is considered necessary. The decision of which field aspects to continue with will be made early in 1996. Definitely the examination of chemical water qualities at waterholes and their temporal variabilities during the year (point 3.) as well as the investigation of underutilized chemical water qualities and of 'acceptance limits' will be taken further (points 4. and 5.).
Focus will be put on the analyses of the collected data (points 7. and 8.) and, as soon as results are evident, on the finding of solutions together with the Park Management (point 9.).

7 COOPERATION WITH OTHER PROJECTS

This study is carried out in conjunction with other research projects at the Etosha Ecological Institute on predators, disease and food. Close cooperation in the sense of complementation exists with the project of W.P. du Plessis on food quality and availability in the ENP.

Furthermore, there are connections between this study and the future GTZ - funded project of Dipl.-Geographer Dr. phil. habil. Manfred W. Buch on 'Environmental Change and Natural

Resources Conservation in Northern Namibia II - Towards a Parametric Assessment of Landscape-Ecological Risks and the Implementation of a Sustainable Environmental Management'. Involved institutions are the Etosha Ecological Institute in Okaukuejo/Namibia, the Agricultural Laboratory in Windhoek/Namibia and the University of Regensburg/Germany.

Further cooperation exists with the research cooperation project on 'Regional Environmental Change in Northern Namibia - A Remote Sensing Approach' between the EEI/Namibia and the Natural Resources Institute/U.K..

8 LINKS TO THE "NAPCOD" PROGRAMME

This study can be a valuable contribution to Namibia's Programme to Combat Desertification (NAPCOD). Water availability and water quality are important factors contributing to desertification in Namibia. By understanding and comparing the use of water by wildlife and by domestic stock, e.g. their water requirements, drinking habits, their maximum distance of daily movements from waterholes and their water quality preferences, recommendations can be made for the water management of farming areas in Namibia. This includes information on whether an area will be better utilized by wildlife or stock, and on appropriate waterhole management, both with the main aim of preventing land degradation.

The following specific links can be drawn to NAPCOD (in brackets are references to Activities (points 3.1 - 3.11.)):

1. The water provision situation at waterholes in Etosha (number, distribution and changes of water availability, see 3.1. a and b) will be compared with available published research results on the water provision in selected areas outside the Park where domestic stock is kept. Focus will be put on comparing the changes of the situation throughout the year and the response of wildlife and stock or stock owners to changing conditions. This will help identifying factors contributing to land degradation around waterholes.

2. The water provision requirements of wildlife and domestic stock will be compared by investigating the daily maximum distance that wildlife and domestic stock are able to travel between forage areas and waterholes (see 3.2. b), as well as the drinking frequency of both wildlife and

stock (see 3.2. c). The data on domestic stock will be obtained by using research results gained by other studies in Namibia.
Thus valuable information will be provided for the decision making on whether an area will be better utilized by wildlife or by stock, especially in the respect of the sustainable utilization of an area and the prevention of land degradation.

3. The chemical qualities of water at selected waterholes in areas surrounding Etosha will be compared with guidelines for stockwatering set up by the Department of Water Affairs (1991) and by the results of water quality acceptance limits of wildlife, as investigated in this study (3.4. and 3.5.). Thus, recommendations can be given on which areas outside Etosha would be usable by wildlife rather than domestic stock.

4. Time series analyses of chemical water quality data of different regions in Namibia will be undertaken in order to identify temporal variabilities (3.3.). The worst water qualities occuring within the year will then be compared with the recommended water quality limits for domestic stock (Department of Water Affairs, 1991) and the acceptance limits for wildlife (as identified in this study).

5. The modelling and testing of low-cost solutions for the Park Management to improve problematic water quality and availability situation will provide relevant information on waterhole management for areas outside of Etosha (3.9. , 3.10. and 3.11.).

8 PROJECT BUDGET 1/96 UNTIL 12/96 (IN N$)

Budget Items	Namibian Dollars
Salary Researcher Salary (4000 N$/month)	**48 000,00**
Equipment 1 Laptop Computer (e.g. Laptech 7500 series i486) with printer	17 000,00
SUBTOTAL	**17 000,00**
Disposable Equipment Stationaries incl. films for documentation	1 000,00
SUBTOTAL	**1 000,00**
Transport Vehicle running costs (1,5 N$ per km at 1000 km / month)	18 000,00
"Acceptance limits" investigation (point 5.)	10 000,00
SUBTOTAL	**28 000,00**
GRAND TOTAL	**94 000,00**

The project executant will provide her own vehicle and accomodation in the ENP. After the end of this project the equipment will be handed over to the EEI and thus be of further benefit for the Institute.

9 REFERENCES

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