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Childes, Susan Lawley

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THE POPULATION DYNAMICS OF SOME WOODY SPECIES IN THE KALAHARI SAND VEGETATION OF HWANGE NATIONAL PARK

Susan Lawley Childes

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ABSTRACT

THE POPULATION DYNAMICS OF SOME WOODY SPECIES IN THE KALAHARI SAND VEGETATION OF HWANGE NATIONAL PARK

CHILDES, Susan Lawley, M.Sc. University of the Witwatersrand, Johannesburg, 1984.

The population dynamics and principal controlling factors of six woody species found in the Kalahari Sand vegetation of Hwange National Park are investigated. The populations from woodland and scrub areas of known human disturbance (logging) are compared with undisturbed sites. The effects of edaphic factors, frost, fire and elephant damage on the woody species are examined.

The results show the populations from the disturbed areas to be generally unstable with a decline in the woodlands. The estimated recruitment of Baikiaea plurijuga is 0,2 of the rate needed to maintain the woodlands in the present state. The influence of soil moisture is of major importance in determining vegetation physiognomy and species composition. Frost and fire also have a strong modifying influence on the vegetation through the differing sensitivities of each species. Frost, fire and elephant account for 57%, 24% and 19% of the damage (excluding unknown factors).

In conclusion a hypothesis showing the interaction of abiotic and biotic factors on the three stages of vegetation cycling : woodland, scrub and grassland, is presented.

DECLARATION

I declare that this dissertation is my own, unaided work. It is being submitted for the degree of Master of Science in the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination in any other University.

Susan Lawley Childes

Susan Lawley Childes

20 day of March, 1984.

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PREFACE

This dissertation was undertaken as a part-time study while I was employed as an Ecologist by the Department of National Parks and Wildlife Management. The study was also listed as a Departmental project for Hwange National Park.

The purpose of the study was to test and develop earlier work by my supervisor, Prof. B.H. Walker, and my predecessor, Mr J.E. Rushworth, on the pattern and dynamics of Kalahari Sand vegetation. A further understanding of the Kalahari Sand ecosystem would provide a firmer base for Park management.

The study was limited to the population dynamics of six of the main woody species found in woodland and scrub communities on the Sands. It continued through three dry seasons and two wet seasons from 1980 - 1982.

I wish to thank Ms W. Knoop for her invaluable help with the computer program, Mr G.M. Calvert and the Forestry Commission for making data and reports available, Mrs J. Hussein and the Department of Research and Specialist Services for the loan of the soil moisture meter and the soil analyses, and Dr T. Smith for testing the Baikiaea population model. Assistance in the field from the Research Scouts at Main Camp is gratefully acknowledged. Finally, I am thankful to my supervisor for his stimulating discussions and guidance.

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CHAPTER 1. INTRODUCTION

Hwange (formerly Wankie) National Park is the largest National Park in Zimbabwe and the third largest in Africa.

Despite its recent history of human interference, much of Hwange still remains a comparatively untouched wilderness, particularly in the dry, flat Kalahari Sand country. A brief review of past disturbances and the problems associated with the establishment of the Park are given below. A more detailed historical perspective appears in Chapter 2.

At the beginning of this century the only inhabitants of the Kalahari Sands were nomadic Bushmen. European influence was initally centred around hunting the game which migrated from the waterless Sands to the Gwaai river during the dry months. Later, the value of indigenous timber was realised and exploitation of the teak or 'mkusi' (Baikiaea plurijuga) commenced, with overall development of the country. Much of the timber extraction was uncontrolled and without any regard to the future of the slow growing forests. The direct and indirect effects of this disturbance are of major importance in the modification of Kalahari Sand vegetation. A second factor, responsible for much of the fire damage to the vegetation, was the construction of a railway line from Bulawayo to Victoria Falls. Steam locomotives were, and still are, a continual source of fire.

As with most protected wildlife areas, there arose a conflict between wildlife and domestic stock. In 1960 a fence was erected to prevent the spread of foot and mouth disease to cattle in the adjacent farming areas. The fence ran from the Gwaai river south to the Botswana border. Since it was habitually broken by elephant, buffalo and wildebeest, it became Veterinary Department and

National Parks policy to shoot all game within a mile of the fence. This caused a heavy drain on the game population (Davison, 1977). The effects of this fence protection must have improved the balance between herbivore and predator populations, as it had been the practice for the previous 30 years to reduce lion, hyaena and wild dog numbers. In 1981/82 a 'game-proof' fence was erected by Botswana authorities along the south western boundary of the Park. The repercussions of this barrier on the movements of buffalo, elephant and other species remain to be seen, but will probably cause a further compression of game into the Park.

Another major problem in the Kalahari Sand region is the presence of widespread artifically supplied water during the dry season. Boreholes were first sunk in the 1940's in order to attract the game away from the farming areas. The permanent water supplies soon began to have an effect on game migrations and by 1945 elephant and buffalo appeared in greater numbers (Davison, 1977). Wankie Game Reserve was officially designated as a National Park in 1950 and following this, tourism became an important consideration in the Park. Pumped waterholes became popular game viewing spots, but because of game pressure the vegetation was heavily damaged. Further boreholes were then drilled in an attempt to alleviate the pressures around the older waterholes. The provision of additional water during the critical dry season did little to reduce vegetation damage but allowed herbivore populations, especially elephant, to increase. Levels of elephant damage became unacceptable and in 1970 a population reduction exercise began, and continued annually.

To summarize, the Kalahari Sand vegetation of Hwange has been subjected to a past eighty years of

disturbance through timber extraction and an increase in game populations and fire frequency. As most of the vegetation is dominated by woody plants (for explanation see Chapter 6), the effects of disturbance would be reflected in these species. The vegetation falls into two main physiognomic categories: woodland, dominated by Baikiaea plurijuga, and scrub, dominated by Terminalia sericea. The questions underlying this project were firstly, are the woodland and scrub areas inherently the same, i.e.: stages in a succession? Secondly, what factors cause changes in the vegetation, and what is the effect of past disturbance? The study focussed on the two dominant species B. plurijuga and T. sericea. Four other woody species were also considered as they are common components of woodland and scrub communities. Those were Guibourtia coleosperma, Burkea africana, Erythrophleum africanum and Ochna pulchra.

The objectives of the study were to determine:

(i) The population status and dynamics of these six woody plants.

(ii) What factors influence the vegetation structure, composition and dynamics. This would then provide an insight as to whether management was feasible or necessary to counter the effects of these factors.

The following is a résumé of the work, outlining the arrangement and themes of the chapters. Chapter 2 introduces the study area, with details of past history, climate, soils, vegetation and animals. Chapter 3 provides the literary background with a discussion of the work of early botanists and forestry officers on Kalahari Sand vegetation, together with more recent research and ideas. In Chapter 4 the theme of a comparison between woodland

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