

Fire impacts on the vegetation in the Kavango Region

for

Environmental Profile of the Kavango Region Project

Antje Burke, February 2002

INTRODUCTION

EnviroScience had been contracted by the Environmental Profile of the Kavango Region Project to undertake a focussed review of the impacts of fire on the vegetation in the Kavango Region. With the main objective to review the effects of widespread and frequent burning on vegetation in the Kavango region, the brief report is structured according to the Terms of Reference for this short-term consultancy:

- Approach
- Savanna dynamics and fire research
- Effects on woodlands
- Effects on pastures
- Effects on bush encroachment
- Effects on floodplain vegetation and
- Social impacts.

APPROACH

This brief consultancy allowed for a literature review, but prevented extensive consultation with all parties involved in fire management and control in Namibia. Consultations were thus limited to the Directorate of Forestry which (to my knowledge) is the only agency actively involved in fire management in Kavango Region. Published literature on the topic of savannas and fires as well as internal reports of relevance to the Kavango Region were reviewed. This review also includes field observations made by the author during a vegetation survey of the Kavango Region in 1999.

This review has been summarised in two different reports. A scientific review of savanna dynamics and fire impacts in general, based on published information was considered necessary to provide adequate background and has been summarised in form of a review paper. This report addresses fire impacts in Kavango more specifically and apart from some necessary points from the “scientific” review, includes personal observations.

SAVANNA DYNAMICS AND FIRE RESEARCH

The five simple questions posed in the Terms of Reference for this consultancy cannot be adequately dealt with without a brief review of fire research and savanna dynamics. Savannas are broadly defined as tree – grass co-dominated vegetation types. The ratio between grass and tree component is dynamic and influenced by an array of internal variables such as competition and external variables, e.g. climate, substrate, topography and the two overriding

factors fire and herbivory. All these in concert plus site history (i.e. past and present burning regime, grazing intensity and other resource use and disturbances) determine the dominance of either the tree or grass component at a particular site.

Fire impacts have to be determined in the context of prevailing fire regime, i.e.:

- type of fire (e.g. surface or crown fire)
- fire season (timing and duration of burning)
- fire intensity (which depends on type of fuel and fuel load available) and
- frequency of fires.

If all the above variables were known, assessing and predicting the impact of fire on a particular vegetation type would be comparatively simple. This is unfortunately never the case, and even controlled burning experiments do not always manage to keep all other variables constant to assess the impact of one particular factor. However, significant progress has been made over the past few decades.

There is no doubt that fire regime, particularly the time of burning has been changed with the advent of modern man on the African continent. When these changes first became evident in savanna vegetation is unknown. Today most fires are lit by humans "out of season", i.e. during the dry season. "Natural" fires associated with thunderstorms were most frequent during the first rains. Also likely the interval between fires at a particular site has been shortened, narrowing the recruitment window for many woody species which may selectively exclude fire-sensitive species. During 1996 – 1999, for example, the area burned each year in the Kavango Region steadily increased from 45 to 65 % (el Obeid & Mendelohn 2001).

EFFECTS OF WIDESPREAD AND FREQUENT BURNING ON WOODLANDS

As explained above, there is probably no patch of woodland in Namibia that could be considered "natural" (i.e. unaffected by change in burning regime). It is difficult for this reason to assess the impacts of fire without a "control" for comparison.

The impacts will vary according to vegetation type, environmental conditions, past site history, fire regime and other disturbances. With this in mind, and the paucity of research in Namibia investigating fire impacts on the natural vegetation, only very few general trends can be provided:

The most evident direct impacts of fire on woodlands in the Kavango Region are:

- removal of undergrowth and grass
- change of vegetation structure, and
- change in species composition.

Repeated, intense fires, for example, have been attributed to create a pronounced two-pronged size distribution of trees with typically several tall trees and many low shrubs and tree regrowth confined permanently to the flame zone (Trollope & Trollope 1999). Only fire-tolerant trees and shrubs can endure such treatment over the long-term. The prevalence of *Baphia massaiensis* and *Terminalia sericea* thickets in some areas could point to such impacts.

Fire-sensitive species are particularly affected by frequent burning, as they will be unable to grow tall enough to escape the flame zone. *Baikiaea plurijuga*, *Guibourtia coleosperma* and *Commiphora* species (Geldenhuys 1977), have been named as fire sensitive. Particularly

Baikiaea woodlands are today limited in the Kavango Region, but *Baikiaea* has also been harvested for timber and pure *Baikiaea* stands are associated with specific soil conditions (Mitlöhner 1993). So whether or not *Baikiaea* woodland was more widespread in the past will need to be assessed on the basis of historic information.

There are also various indirect and less evident impacts associated with fire. Nutrient cycling is affected by fire, through rapid destruction of the organic layer, nutrient release and likely also nutrient loss (some element such as nitrogen and sulphur) are lost to the atmosphere. Depending on topography and the level of destruction of the soil protecting organic layer there may be increased soil erosion. Soil formation may also be affected, as impermeable layers in the soil were encountered during recent soil survey which could be associated with fire impacts (Simmonds 2000).

EFFECTS OF WIDESPREAD AND FREQUENT BURNING ON PASTURES

As with woodlands, a change in burning regime is also expected to affect the composition of pastures in the Kavango. Savanna grasses are naturally adapted to cope with fires. However, it is likely that fire tolerance levels vary between species. During this review no information was found addressing fire sensitivity of Kavango grasses on a species level. Also the effect of fire is compounded by grazing impacts which can rarely be separated in woodland areas of Kavango. However, removal of moribund grass by burning to improve rangeland condition and reduce fire hazard is widely practised in southern Africa and has also been suggested as a management strategy for Namibian woodlands (Trollope & Trollope 1999).

The indirect effects related to nutrient cycling, soil formation and erosion detailed above would also affect pastures in the long-term, likely resulting in change in species composition, perhaps towards less nutrient-rich grasses.

EFFECTS OF WIDESPREAD AND FREQUENT BURNING ON BUSH ENCROACHMENT

The control of bush encroachment by means of hot, intense burning and other burning techniques has been practised in other parts of the country (Strohbach 1996), but not in the Kavango Region. In a recent study in Kalahari woodland of Eastern Caprivi, Trollope & Trollope (1999) suggested a direct link between suppression of fire coupled with intense livestock grazing and bush encroachment.

EFFECTS OF WIDESPREAD AND FREQUENT BURNING ON FLOODPLAIN VEGETATION

The burning of floodplain vegetation is widely practised in the Eastern Caprivi. Whether or not this is a widespread practise along the more populated Kavango River, I am unable to say. With reference to this practise in the Caprivi Region, the floodplain grasslands are mainly burned to encourage the growth of new high quality thatching grass. The Caprivi floodplains apparently require frequent burning which apart from good thatching grass and grazing has the added benefit of tick removal and preparation of land for cultivation (Trollope & Trollope 1999). The ecological effects of frequent burning in these grasslands are unknown.

THE SOCIAL IMPACTS OF WIDESPREAD AND FREQUENT BURNING

As this has not been the major focus for this review, and no published or reported information was obtained, only a few general observations, based on my own reflections are provided here.

- The direct effects of uncontrolled wildfires of people losing livestock, homesteads and perhaps relatives are likely restricted to few incidences.
- The present burning regime in woodlands of the Kavango and perceived changes in soil, vegetation and other biota are not likely to provide a more diverse and resilient resource base.
- Furthermore, trends point to a gradual degradation which in the long-term may negatively affect land at present suitable for farming and grazing.

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