ELSEVIER

Journal of Arid Environments 68 (2007) 77–87

Journal of Arid Environments

www.elsevier.com/locate/jnlabr/yjare

Fire activity on drylands and floodplains in the southern Okavango Delta, Botswana

M. Heinl[a,*], P. Frost[b], C. Vanderpost[c], J. Sliva[a]

[a]*Technische Universitaet Muenchen, Am Hochanger 6, D-85350 Freising, Germany*
[b]*Institute of Environmental Studies, University of Zimbabwe, P.O. Box MP 167, Mt. Pleasant, Harare, Zimbabwe*
[c]*Harry Oppenheimer Okavango Research Centre, University of Botswana, Private Bag 285, Maun, Botswana*

Received 18 January 2005; received in revised form 30 September 2005; accepted 15 October 2005
Available online 8 May 2006

Abstract

Satellite imagery derived fire history data for the southern Okavango Delta, Botswana from 1989 to 2003 were used to analyse the temporal and spatial distribution of fires and to assess changes in fire activity. Maximum fire activity was encountered for 1997 with 24.1% of the study area burned. The annual extent of the burned area fluctuated considerably, but there appeared to be a regular oscillation apparently induced by floodplain fires. The main fire activity on drylands is in September at the end of the dry season, while most floodplains burn earlier in the year. Both burning of floodplains and drylands appear to peak prior to floods and rainfall-events, respectively. Areas with highest fire frequency were outlined and spatial analyses showed that fires on the drylands are largely due to burning of adjacent floodplains. The floodplains were therefore identified as the centres of fire activity, being the regions with the highest fire frequency and serving as source of fires spreading into drylands. Floodplains showed higher fire frequencies compared to drylands, but no increase in fire activity was detected over the study period for both floodplains and drylands.

Keywords: Savanna; Fire season; Fire regime; Fire frequency; Wetland; Southern Africa

1. Introduction

Fire is a natural process that has been part of the functioning of many ecosystems for millennia, particularly in southern Africa. Even fires started by people must be

*Corresponding author. Tel.: +49 8161 713715; fax: +49 8161 714143.
E-mail address: heinl@wzw.tum.de (M. Heinl).

0140-1963/$ - see front matter
doi:10.1016/j.jaridenv.2005.10.023

considered as part of the process, given the antiquity of human existence in Africa. Evidence for the use of fire by Stone-Age people in Zambia goes back as far as 55,000 years ago (Clark and van Zinderen Bakker, 1964), pre-dating present plant communities. Brain and Sillen (1988) report signs of even earlier use of fire by hominids at the Swartkrans Cave, South Africa, dated at about 1.2 million years BP.

Today, fire is a widespread phenomenon throughout tropical and subtropical southern Africa, occurring mostly during the annual dry season (May–October in southern Africa) when the herbaceous vegetation is either dormant or, in the case of annual grasslands, dead, and when deciduous trees have shed their leaves (Frost, 1999). These conditions contribute to an accumulation of dry, easily combustible, fine fuels. Fire is generally less frequent in drier regions where low rainfall limits the production of biomass fuels (grass, shrubs, litter and dead wood) (Bond, 1997; van Wilgen and Scholes, 1997). In these areas, several years of fuel accumulation, or an exceptionally wet preceding growing season, are needed to produce sufficient fuel to support a spreading fire.

The Okavango Delta is unique in that it is an extensive wetland ecosystem within an otherwise arid environment. Plant production and, in turn, the output of potential fuel for fire, depends more on the extent, level and duration of flooding, particularly in the seasonal swamps and floodplains of the southern Delta, than on the level of incident rainfall (Heinl et al., 2006). Towards the southern parts of the Delta, where flooding is more seasonal and there is more woody vegetation, fires occur across all landscape units, though they are most extensive in the seasonally flooded grasslands (Heinl et al., 2006). Burning within the woodlands is limited largely by the amount of fuel present to maintain a fire, itself inversely proportional to tree canopy cover (Frost, 1996). Generally, fuel loads in the area are relatively low, because of the herbaceous production is limited by low incident rainfall, infertile sandy soils, and high levels of herbivory. When fires do occur, they are usually surface fires of low intensity.

Fires in the Okavango Delta have basically two main sources of ignition: lightning strikes, especially during the 'dry' thunderstorms that are common at the start of the rainy season (October–November), and fires set by people for various purposes, potentially at any time of the year. Reasons for burning include efforts to induce higher quality grass regrowth for grazing animals or to attract wildlife for hunting, to clear land for cultivation close to or in floodplains where flood-recession (or molapo) farming is practiced or to clear channels on the floodplains to improve access to fishing grounds. Accidental fires are caused by campfires, fish-smoking or collecting honey (Cassidy, 2003). Although most fires are considered to have an anthropogenic origin, they usually spread uncontrolled and can extend over many square kilometres, if fuel loads are sufficient.

In recent years, concerns have been expressed by local organizations that fire regimes have changed significantly in recent times as human population densities, and therefore the number of potential ignition sources, have risen (OWLS, 1998; Cassidy, 2003). Fires are said to be more frequent than in the past and, in aggregate, to burn a greater portion of the landscape. Though quantitative data are lacking. To address these concerns and the lack of data, a series of satellite images covering a 15-year period were analysed to reconstruct the spatial and temporal distribution of fires for the southern floodplains of the Okavango Delta.