

# FOREST FIRE SYNOPSIS: A NAMIBIAN CONTEXT 2006 – 2007

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## ABSTRACT

All people living on the planet depend directly or indirectly on natural resources, and in Namibia, rural people who live on communal land are largely sustained by it. In this environment, uncontrolled and severe forest fires threaten human life and resources, and could result in the extinction of certain species of plants and animals. Forest fires in Namibia can be due to natural causes but are more often caused by humans, and normally occur during the dry, hot seasons. This paper presents the results of mapped fire scars across the whole of Namibia for 2006–2007. Namibia's highest rainfall figures are recorded in the north to far north-east of the country. Consequently more woody resources with a higher biomass are found in these regions than elsewhere, and they are harder hit by fires. Higher forest cover, or biomass, is generated in part by rainfall and weather conditions, and these factors play an important role in forest fire incidence. GIS and remote sensing techniques were used by the National Remote Sensing Centre (NRSC) of the Directorate of Forestry (DoF) to map out fire scars. The active fire points downloaded from the Department of Geography of the University of Maryland and MODIS Rapid Response web site were overlaid with the satellite imagery to cross-check fire scars. Polygons were then digitised around the fire scars on the image, using ArcView GIS 3.2, the areas calculated and added to determine the total area burned per region in hectares. The Directorate of Forestry utilises these fire maps for decision making, fire monitoring, planning and designing public awareness campaigns.

Key words: Forest fire, fire scar, GIS, remote sensing, Modis satellite image, Namibia

## INTRODUCTION

All people living on the planet depend directly or indirectly on natural resources. In Namibia, rural people who live on communal land, especially in the north, north-east and north-west, are largely sustained by natural resources. These areas receive more rainfall and support more woody growth than areas elsewhere in Namibia. Simon Trigg (2000) describes the "... predominance of woodland and savanna vegetation in Namibia which follows the rainfall gradient from the eastern and central regions to the deserts in the west." The rainfall and vegetation changes described here, explain the relationship that exists between forest fires, the amount of biomass or forest cover, rainfall gradients and weather conditions in different parts of Namibia. Forest fires in Namibia are caused either by man, or through natural

occurrences during different climatic conditions and seasons. Man-made fires are started through agricultural activities, land management procedures and uncontrolled actions, whilst natural fire is ignited by lightning. All types of fire can be extremely destructive.

The Directorate of Forestry in Namibia has the mandate to monitor, manage and control forest fires. In executing these tasks the National Remote Sensing Centre uses Geographical Information Systems (GIS) and Remote Sensing (RS) to map detected fire scars. Collected information, findings and produced fire maps are used by the Directorate of Forestry and other stakeholders for decision making, fire monitoring, management, planning, notification of the public and fire sensitisation campaigns.

To ensure that the forests are protected from destructive forest fires and effectively managed for future purposes, the Directorate of Forestry has put in place measures such as forest fire mapping and monitoring. In addition, a draft fire policy will be enacted soonest.

## OBJECTIVES

- To map forest fire incidence
- To identify the worst affected or most burnt areas or regions
- To estimate the total surface area burned per region

## SPATIAL LOCATION OF THE STUDY AREA

Namibia has a multi-ethnic population size of 1 830 330 (Central Bureau of Statistics, 2001) on a land surface of 824 268 km<sup>2</sup>. It shares international borders with South Africa, Botswana, Zambia and Angola, and the Atlantic Ocean lies to the west of the country. Geographically it lies between 17° and 29° S and 12° and 25° E (Figure 1). Classified as the driest country in Sub-Saharan Africa with Kalahari semi-desert in the east and the Namib Desert on the western edge (Christelis & Struckmeier, 2001), the country has sporadic rainfall patterns with a mean annual rainfall of between 50 mm in the west to 650 mm in the far north-eastern regions. The climate is unpredictable due to great sequential and spatial perturbations in rain patterns (Mwazi & Shamathe, 2007).

## METHODS AND MATERIALS

Various remote-sensing and GIS tools and techniques were applied. Satellite imagery was used for visualisation of burnt areas onto which the active fire point data were overlaid.



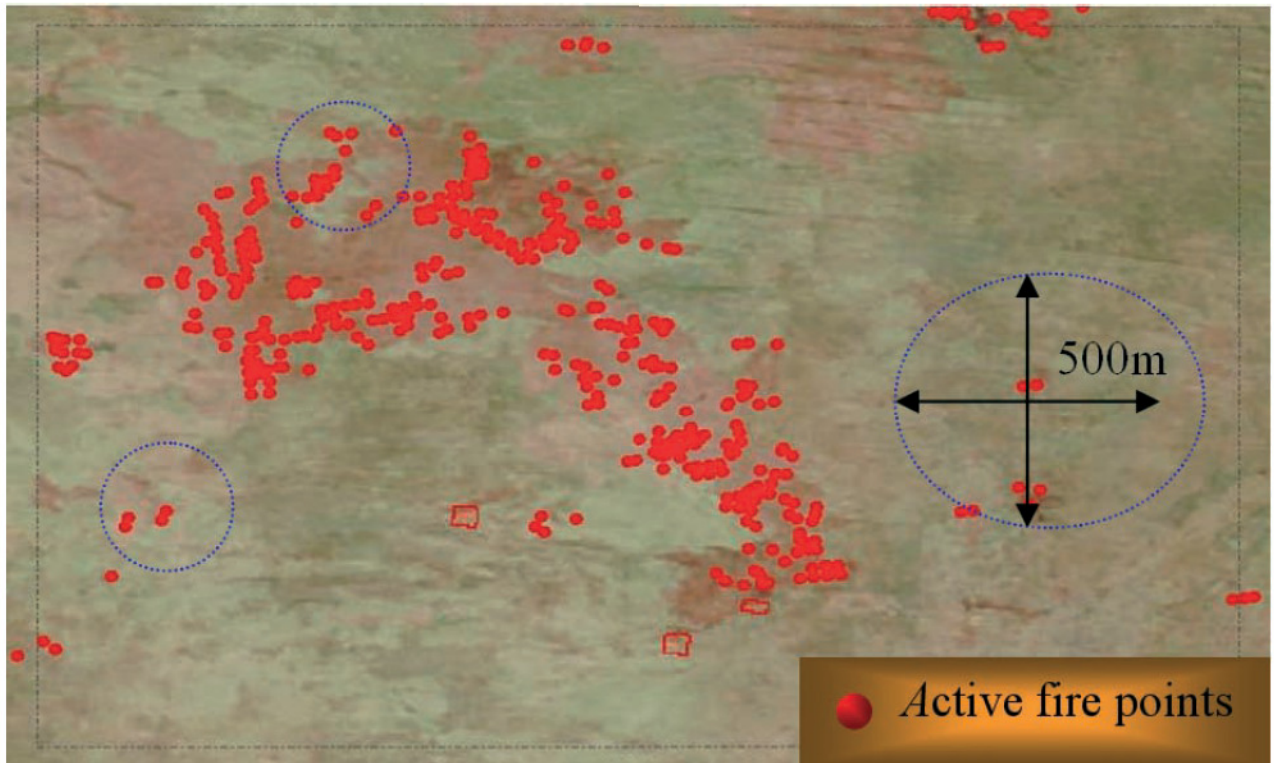


Figure 2. Modis satellite image overlaid with active fire points with 500 m radius buffering.



Figure 3. Modis satellite image with delineated fire scar polygon.

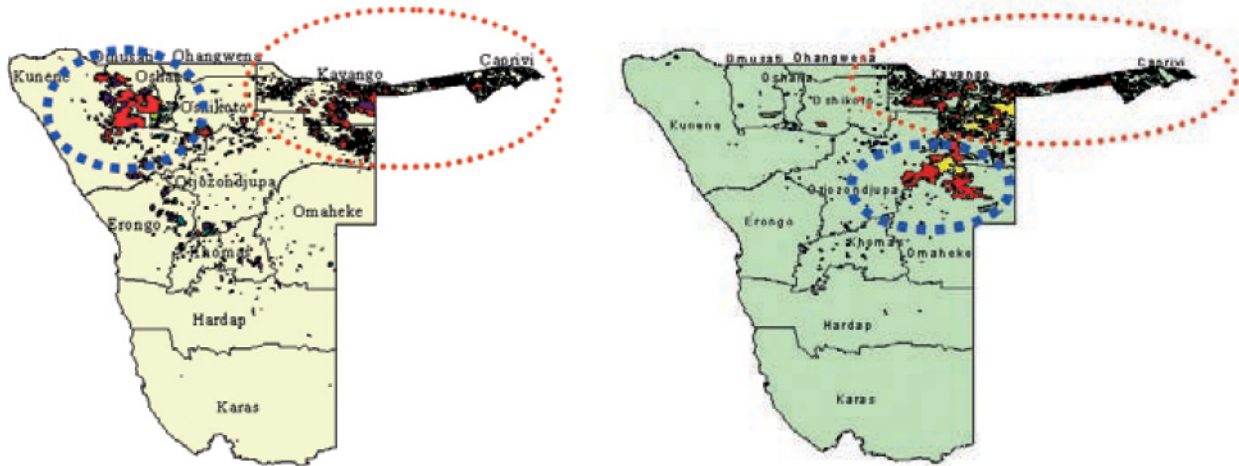


Figure 4a and b. Shifts in the fire-prone areas in 2006 and 2007.

were rated the second and third highest respectively. The areas burned in Omusati, Kunene and Caprivi declined in 2007 (Figure 6).

Cross-border fires have been observed (Figure 5), which indicates that some of the fires may originate in neighbouring countries or vice versa. It must also be noted that regions such as Kavango, Caprivi and especially western Otjozondjupa, with the highest incidence of fires, all border on neighbouring countries. This study shows that in these regions, the burnt areas occur more often along international boundaries than elsewhere. This indicates a trend of cross-border fires between neighbouring states (as depicted by the white arrows pointing in both directions). The question of where most of the fires originate – outside or within Namibia – remains open and could only be established through further research, but such an investigation lies beyond the scope of this study.

### CONCLUSION

The heterogeneous factors that lead to fire occurrence, the absence of policies and legislation regulating fire control, availability of resources (human and physical) employed in fire management, differences in levels of understanding, traditions and livelihoods all complicate

successful fire management. With many of the necessary components in short supply or entirely lacking, fires have to date been managed with limited success. However, the study does uncover some successes. For example, the shift in fire prevalence from one region to another can be partly attributed to ongoing fire awareness campaigns, especially in Caprivi as compared to Kavango. The intensified efforts between the Directorate of Forestry, CNEN and community fire management projects on sensitisation have had a positive impact. Most of the burning took place during August and September. Thus, the study concluded that fires are mainly started by people, since lightning storms do not occur in these months. The incidence of fires along international borders signals the need for collaboration and cooperation between neighbouring countries and fire stakeholders. Resource sharing between bordering countries is of vital importance if uncontrolled fires are to be curtailed, and this urgently needs to be done.

### RECOMMENDATIONS

The study proposed the following:

- People should be sensitised to resource conservation and sustainable utilisation through frequent fire awareness campaigns.

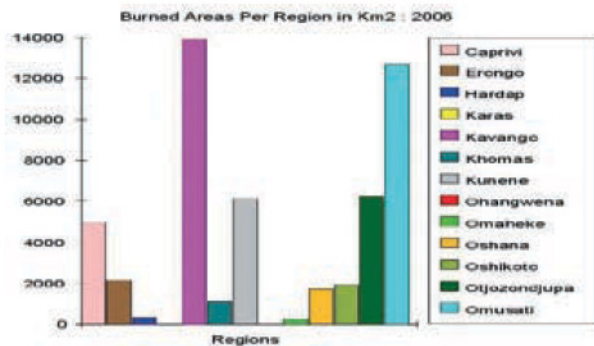


Figure 5. Burned areas in 2006.

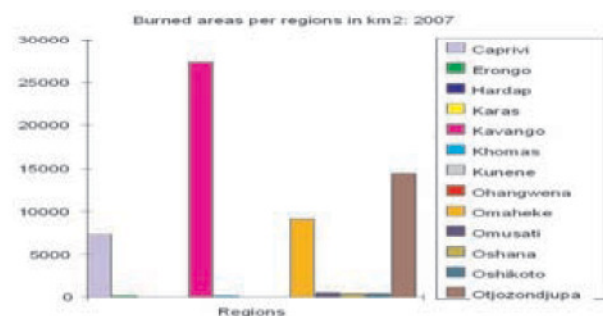


Figure 6. Burned areas in 2007.

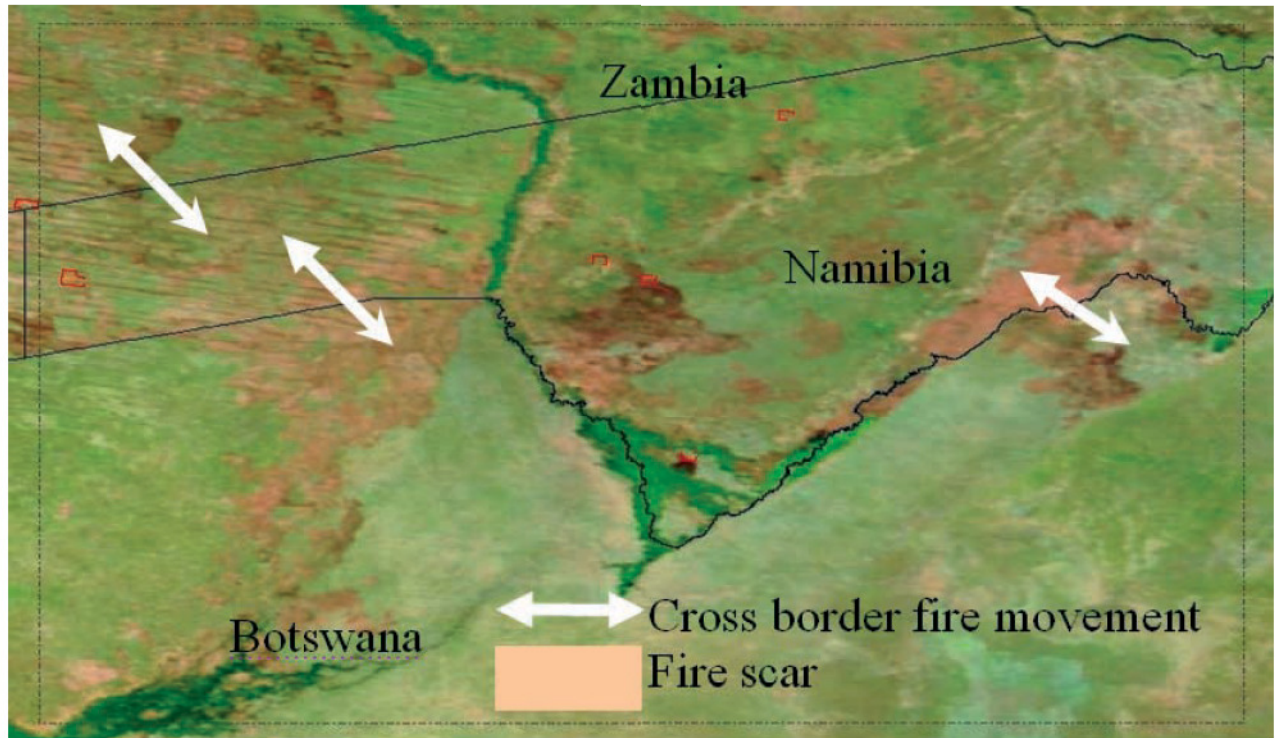


Figure 7. Cross-border fire scars indicated by white arrows on the Modis satellite image

- Needs identification and intensified training of relevant stakeholders should be further promoted and executed.
- Fire sensitisation workshops should be held annually before the burning season (August to September).
- The development of community forests and conservancies should be further encouraged to allow communities to take ownership of their natural resources and to benefit from their sales. This may discourage them from mismanagement and encourage conservation of their valuable resources.
- Forest firebreaks must be established before the burning season and regularly maintained.
- Coordination and collaboration with neighbouring states on cross-border fire matters should be encouraged.
- Synchronisation (harmonisation) and sharing of human and physical resources between states and stakeholders should be promoted.

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