

(Format No. 3)

## SUMMARY OF DOCTORAL THESIS

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**Title of Doctoral Thesis:** Fire Monitoring in Savanna Ecosystems Using Remote Sensing and GIS: Implications for selected herbivores in Kruger National Park, South Africa

(リモートセンシングと GIS を用いたサバンナ生態系の火入れモニタリング：  
南アフリカ共和国クルーガー国立公園における特定草食動物への適用)

The heterogeneity of savanna ecosystems is guaranteed by disturbance events like fires, droughts, floods and browsing and grazing by herbivores. In many conservation areas, which savanna is their main vegetation type, fire is used as a management tool stimulating sprouting of plants with high forage quality that attract higher density of herbivores. In these areas, like Kruger National Park (KNP), with limited space to preserve biodiversity, fire monitoring is crucial. Long periods of satellite remotely sensed data provide an alternative solution to estimate the distribution of different vegetation types and fire-affected patches through time. This study focuses on application of MODIS data to monitor, identify and delineate, fire-affected areas in KNP and the implications of fire on feeding strategy of three selected megaherbivores: The African buffalo (*Syncerus caffer* Sparrman), the African elephant (*Loxodonta Africana*) and rhino (white: *Ceratotherium simum*, black: *Diceros bicornis*).

Fire scars on KNP's savanna were identified using threshold and supervised classification methods on MODIS (Moderate Resolution Imaging Spectroradiometer) using a combination of band 1 (red), 2 (NIR, near infrared), 4 (green) and 6 (SWIR, short wave infrared). On identified fire scars the spectral indexes of albedo, NDII (Normalized Difference Infrared Index) and NDVI (Normalized Difference Vegetation Index) were extracted. Four broad habitat types were used for this analysis: riparian woodland, dense woodland, mixed woodland and open tree savanna. The fire impact on feeding strategy of herbivores was analysed by observing and recording the total numbers of African buffalo, African elephant and rhino daily sightings by rangers on fire affected patches. NDVI values of the fire affected patches were also calculated on 16-day composite period before the fire, during the fire period and the following 16-day composite post fire periods until the end of the rainy season.

The results show that the values of albedo, NDII and NDVI during the dry season (June to October) for different years are lower on fire-affected patches. Mixed woodland is the largest habitat burned with 21%, 43% and 2% of KNP area affected by fire in 2001, 2002 and 2003 respectively. Riparian woodland is the least affected by fire. African buffalo and rhino prefer burned vegetation, with high NDVI values, for feeding, especially in the beginning of the rainy season. However, when vegetation is not a limiting factor they have no preference either to burned or unburned vegetation. Elephants having diversified diet are not fire dependent for food. Supervised classification method has more accuracy for fire scars detection in KNP savannas during the dry season. MODIS data can be used successfully for fire monitoring in savanna ecosystems.

**Key words:** Savanna fire, MODIS's NDVI, conservation areas, African mega-herbivores