

# **An Integrated Fire Management System for the Kruger National Park in South Africa**

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## **Abstract**

The Kruger National Park was renowned for using a rotational, block-burning program for nearly 40 years, until the policy was changed to an intended lightning-driven system in 1993. This latter system failed due to the dominance of wildfires ignited by illegal immigrants from neighbouring countries each year before the commencement of the lightning season during the late winter/ spring period. This led to the formulation and acceptance of a new system with elements of range condition and patch mosaic burning philosophies being integrated with lightning ignitions.

In the new integrated fire management system the Park has been divided into twenty two large and seven small fire management units administered by game rangers. Following assessments of the condition of the grass sward in autumn (March/ April), a target is set for the percentage of each unit to be burnt by the end of the fire season (November), in monthly time-steps. From autumn onwards, game rangers apply patch mosaic fires (initially, numerous small burns) and expect a certain number of wildfires caused by illegal immigrants to occur, the broken fuel bed limiting these. Together, the ranger and wildfires should reach monthly fire management unit targets, the game ranger having the freedom to "catch up" or "slack off" the next month if off-target. By the onset of the lightning season (September), when rangers cease applying controlled burns, a mosaic should be in place which will allow lightning fires to occur and play part of their natural ecological role. Also, the resultant fire mosaic should generally counter extremely large fires, which had become a grave concern during the previously intended lightning burning system. Slight variations of this system will be applied in concession areas of the Park used by private lodges, and variations in the application of range condition criteria inside and outside wilderness areas may produce enough differences to be used as experiments in their own right, the outcomes of which could provide adaptive development of this fire strategy in the future.

## **Introduction**

The Kruger National Park was renowned for using a rotational, block-burning program with modifications for nearly 40 years, until the policy was changed to an intended lightning-driven system in 1993 (van Wilgen et al. 2000). This change was based primarily on the opinion that lightning is the only natural ignition source and in extensive wildlife areas, should be the primary ignition source for fires burning in these ecosystems. It is believed that the biotic and abiotic components of the ecosystem in African savannas have developed in an environment

involving the occurrence of natural fires resulting from lightning. Therefore in areas like national parks a natural fire regime in terms of type and intensity of fire and season and frequency of burning should be driven by lightning as the primary ignition source. It was further reasoned that human interference in the functioning of one component of a natural ecosystem would eventually lead to interference in the other components with unforeseen consequences (Trollope et al. 1995). Another factor involved in changing from the previous burning system were the results of the range monitoring program introduced in 1989. This indicated that the overall condition of the grass sward in the Park had a low diversity of grass species possibly as a result of too frequent burning (Trollope et al. 1991). Nevertheless the lightning burning system failed due to the dominance of wildfires ignited by illegal immigrants from neighbouring countries each year before the commencement of the lightning season during the late winter/spring period. This led to the formulation and acceptance of a new system with elements of range condition and patch mosaic burning philosophies being integrated with lightning ignitions.

### **Procedure**

In the new integrated fire management system the Park has been divided into twenty two large fire management units and seven small fire management units (concession areas) administered by game rangers. Following assessments of the condition of the grass sward in autumn (March/April), a target is set for the percentage of each unit to be burnt by the end of the fire season (November), in monthly time-steps. This target is determined using the annual assessments of the condition of the grass sward. Range condition criteria are applied, based on the botanical composition and physiological state of the grass sward, to decide which areas of the fire management units should be considered for burning. From autumn onwards, game rangers apply patch mosaic fires (initially, numerous small point ignited burns) and expect a certain number of wildfires caused by illegal immigrants to occur, the broken fuel bed limiting these. Together, the controlled and wildfires should reach monthly fire management unit targets, the game ranger having the freedom to "catch up" or "slack off" the next month if off-target. By the onset of the lightning season (September), when rangers cease applying controlled burns, a fire mosaic should be in place which will allow lightning fires to occur and play part of their natural ecological role. Also, the resultant fire mosaic should generally counter extremely large fires, which had become a grave concern during the previously intended lightning burning system. Slight variations of this system are applied in concession areas of the Park used by private lodges, and variations in the application of range condition criteria inside and outside wilderness areas may produce enough differences to be used as experiments in their own right, the outcomes of which could provide adaptive development of this fire strategy in the future.

The range condition criteria that are used to select areas to be considered for burning in the fire management units are:

- The grass sward must (outside of wilderness areas) not be dominated by Increaser II grass species which are pioneer species that increase with heavy utilization and characterise swards with a low grass species diversity. Research in the Park indicates that under free ranging grazing conditions these grass species increase with frequent burning because grazing animals are attracted to the highly palatable regrowth of grass. Therefore rangeland in this condition should not be considered for burning to avoid heavy grazing, thereby promoting and/or maintaining a low diversity of grass species (Trollope et al. 1995).

- The grass fuel load must be greater than approximately 4000 kg/ha because under these conditions the grass sward is in a moribund and unpalatable state requiring some form of defoliation to restore its vigour and grazing potential ( Trollope & Potgieter 1985).

## **Discussion**

One of the current management objectives in the Kruger National Park is to maintain biodiversity in all its natural facets and fluxes. This can be achieved in the context of fire management by maximising the heterogeneity of fire effects through applying a variable fire regime i.e. varying type and intensity of fire and season and frequency of burning. The integrated fire management system is intended to achieve this objective through the development of the following heterogeneous fire regime:

**Type of Fire:** A wide range of types of fires varying from head and back surface fires to crown fires occur with this burning system because all the fires will be ignited by whatever cause as point ignitions. Research in African savannas clearly shows that different types of fires have different effects on grass and woody vegetation (Trollope 1999).

**Fire Intensity:** A wide range of fire intensities will occur with this burning system because it will be applied over an extended burning window from autumn through to spring allowing for a significant variation in the degree of curing of the grass fuel and its consequent effects on fire intensity. Fire intensities will also vary in response to diurnal atmospheric conditions that will occur during the burning of these fires. Variations in fire intensity have significantly different effects on vegetation in African savannas (Trollope 1999)

**Season of Burn:** Fires occur over the entire dormant winter period thereby varying the physiological condition of plants at the time of burning and their consequent response to fires.

**Frequency of Burning :** The integrated fire management system is expected to result in a variable burning frequency because the total area burnt annually will depend upon the condition of the grass sward in response to normal variations in climate and grazing pressure. For example during the drought year 1992 the area to be burnt according to the range condition criteria would have been significantly less than during 1996, a high rainfall year.

The success or failure of the integrated burning system will be evaluated according to a series of ecological criteria that have been developed for the Kruger National Park and referred to as thresholds of potential concern (TPC's) (van Wilgen et al. 1998). These criteria are intended to enable the Kruger National Park to achieve the aforementioned objective of maintaining biotic diversity in all its natural facets and fluxes.

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