

Setting the Thresholds of Potential Concern for Fire

Rationale

Savannas are regarded as event-driven systems (Walker et al., 1986), and hence disturbances such as fire, drought, floods, and herbivory are important mechanisms for producing (and maintaining) the biome (Bond & van Wilgen 1996). Fire is regarded as one of the key agents of disturbance and many descriptors are used to describe disturbance: frequency, predictability, extent, magnitude, synergism, and timing of the event (Pickett & White 1985; Agee 1993, 1998; Morgan et al., 2001). Traditionally fire regimes have been described by: frequency, seasonality, type of fire, and recently intensity (Gill 1975; Trollope 1984).

Over a period of 75 years, fire management in the Kruger National Park (KNP) has matured and evolved from early ideas of the perceived negative effects of fires, to recognising the importance of fires for ecosystem health, then adopting a command-and-control, fixed fire regime to now allowing variability in fire intensity (frequency and season) and patchiness (spatial heterogeneity) (van Wilgen et. al., 2003). This learning and understanding of the role that fire plays in the savanna ecosystem has been achieved through decades of fire research, direct results of experience, and the consequent development and implementation of ideas derived from best available knowledge at the time. The effect of applying a fixed fire regime (frequency and season) on vegetation was investigated by establishing a large-scale, long-term fire experiment in 1954. This experiment has played a pivotal role in developing our understanding of the importance that fires have in our ecosystem.

The original broader set of seven TPC's reflected what was in 1997 (van Wilgen et. al., 1998) seen as the minimum set of factors necessary to monitor all important aspects of fire. The TPC dealing with the % of fires caused by unintended sources (ironically the one exceeded and hence eventually responsible for changing the fire policy) was eventually removed from the TPC list in the belief that cause of fire is ecologically unimportant. Over time it became clearer that the annual area burnt and the seasonal progression of the annual target TPC's were more guidelines for rangers to achieve targets than they were TPC's per se – that is, if they were met, then it was believed that the 'real' or ultimate TPC's would be with limits. A maturation and consolidation of ideas eventually led to just the two current fire TPC's. One representing spatial variation in patchiness and the other variation in intensity. It is believed that these effectively cover for all remaining prior TPC's; and it is even believed that these two can be conflated into one – spatial variation of intensity – at some stage in future. It has even, rather futuristically, been suggested that ultimately these fire TPC's will be subsumed as just part of a spatial variation TPC. At this time we would feel more comfortable with the two fire TPC's separately.

Relation to KNP objectives

The revised objectives no longer state the original foundations for our view on fire as clearly as the 1997 objectives. This is as a result of having moved on to current challenges made possible through what we learnt from assertively leveraging most of the 1997 objectives. The summarised, and now somewhat matured, KNP view is that fires should vary widely over space and time at as many scales as possible, the belief being that this will lead to a range of fire types, intensities and effects, over space and time and that this will most likely best maintain biodiversity.

In light of recent research and understanding (van Wilgen et. al., 2004; Govender et. al., in review) the current TPC's have also mimicked the fire objective development and have incorporated current understanding since their last setting (van Wilgen et. al., 1998), to reflect variability in fire intensity, extent and spatial patterns (Whelan 1995; Brockett 2001; Morgan et al., 2001), are important considerations when assuming the link between patchiness over time and

space, and our biodiversity mandate. Due to widespread concern, the link between tree escape heights relative to fire intensity is being investigated.

TPC

1. Variation in fire intensity

To calculate fire intensity the following parameters will be used:

- fuel load production - predicted from rainfall and time since last fire
- season of burn

Table 1. Fire intensity class will be determined from the following matrix

Season of burn	Descriptor	Fuel loads (kg ha⁻¹)				
		< 1000	1000 – 2000	2000 – 4000	4000 – 6000	> 6000
Summer (1 December – 31 March)	Fire intensity class	Very low	Low	Moderate	Moderate	Moderate
	Mean fire intensity (kW m ⁻¹)	287	578	1031	1432	1650
	Number of fires	1	17	95	83	31
Autumn (1 April – 30 May)	Fire intensity class	Very low	Low	Moderate	High	High
	Mean fire intensity (kW m ⁻¹)	<i>No data</i>	732	1455	2106	1900
	Number of fires	0	19	62	79	23
Winter (1 June – 31 August)	Fire intensity class	Very low	Low	High	High	Very high
	Mean fire intensity (kW m ⁻¹)	194	835	2082	3625	4385
	Number of fires	4	65	187	83	19
Spring (1 September – 30 November)	Fire intensity class	Very low	Low	Moderate	High	Very high
	Mean fire intensity (kW m ⁻¹)	No data	712	1570	3066	5253
	Number of fires	0	15	103	55	16

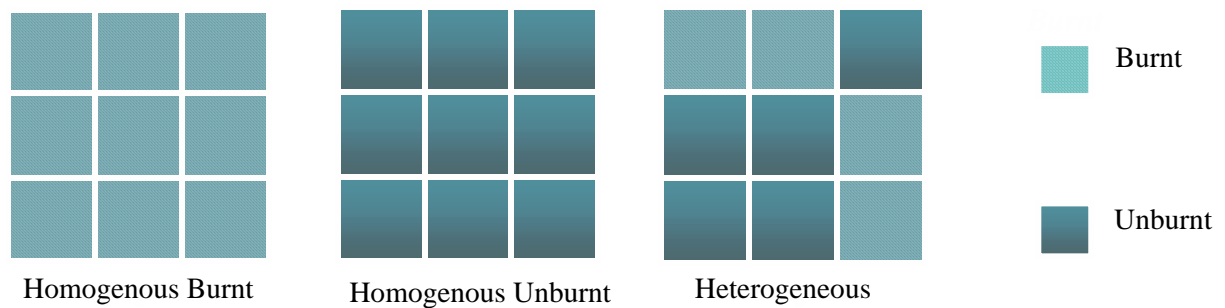
A TPC will be exceeded if:

In any year for each one of the three fire intensity classes, namely low, medium and high, no one should constitute less than 20% or more than 50% of the total area burnt. There should not be dominance of any intensity class over the entire KNP in any year. Over a 5 year period one intensity class should not dominate for 2 or more years.

2. Fire scar pattern index

Fire scar pattern index

By using the moving window analysis tool over the fire scar map of KNP, a Heterogeneity Score (HS) showing the classification used for homogenous unburnt, heterogeneous burnt and homogenous burnt for the entire park is developed. Homogenous unburnt and homogenous burnt is classified as the same (homogenous). The % Heterogeneity score = no. of heterogeneous grids/all grids in park.



The spatial resolution will include:

Grid size of 5x5 cells with cell sizes varying from : 5ha, 25ha, 100ha & 1000ha

This TPC will be evaluated annually.

Preliminary Heterogeneity Score (HS) are set for the different rainfall years and have been based on results from Funda (2002),

Low rainfall (< 400mm) - HS < 2

Medium rainfall (400 – 600) - HS < 6

High rainfall (> 600mm) - HS < 10

The TPC limits are: The HS to fall below the designated limits for any two successive years.

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