Prescribed Burning in African Grasslands and Savannas for Domestic Livestock Systems

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INTRODUCTION

In view of Africa been referred to as the *"Fire Continent"* (Komarek, 1965) prescribed burning has become recognised as an important ecological factor in the grassland and savanna ecosystems of Africa and research investigating the effects of the fire regime on the biotic and abiotic components of the ecosystem has been conducted in these regions since the early period of the twentieth century. This has led to a general understanding of the effects of type and intensity of fire and season and frequency of burning on the grass and tree components of the vegetation i.e. the effects of the fire regime. This in turn has clarified the use of fire as a range management practice and viable prescribed burning programs have been developed for the grassland and savanna areas used for livestock production and for various forms of wildlife management. Experience gained through research on the effects and use of fire in southern and east African grasslands and savannas (Trollope, 1983; Trollope, 1989; Trollope & Potgieter, 1986; van Wilgen, Everson & Trollope, 1990; Trollope & Trollope, 1999; Trollope, *et al.*2000; Trollope & Trollope, 2001) has led to the conclusion that grass and trees and shrubs react similarly to the different components of the fire regime and therefore general guidelines can be formulated for prescribed burning. It is believed that this will best serve the use of fire as a range management practice in the grassland and savanna areas of sub-Saharan Africa. For the sake of clarity guidelines for prescribed burning will be dealt with separately for the use of fire as a range management practice in areas used for livestock husbandry and wildlife management because the broad objectives of management tend to vary for these different forms of land use.

USE OF FIRE AS A RANGE MANAGEMENT PRACTICE FOR LIVESTOCK HUSBANDRY

Prescribed burning is an important and often essential range management practice in areas used for keeping livestock whether it be for commercial or subsistence purposes. The most important factors to consider when planning a burning program are the reasons for burning and the appropriate fire regime to be applied.

Reasons for Burning

The current view amongst range scientists and progressive livestock farmers on the permissible reasons for burning rangeland are that fire can be used to:

- remove moribund and/or unacceptable grass material;
- control and/or prevent the encroachment of undesirable plants (Trollope, 1989).

These are the basic reasons for burning grassland and savanna vegetation in Africa and are both applicable to areas used for commercial or subsistence livestock farming. An often quoted reason for burning rangeland is to stimulate an out of season "*green bite*". This is often done during summer, late autumn or late winter to provide green nutritious regrowth for grazing by livestock. This practice is completely unacceptable because:

- it reduces the vigour of the grass sward;
- it reduces the basal and canopy cover of the grass sward;
- it increases the runoff of rain water;
- it can result in accelerated soil erosion.

This malpractice cannot be condemned enough as it has been responsible for the drastic deterioration in range condition over extensive areas of southern Africa and unfortunate examples of this incorrect use of fire can be seen in the north Eastern Cape Province, Transkei, KwaZulu-Natal and the eastern mountainous grasslands of Mpumalanga in South Africa.

It has been suggested that fire can be used to control ticks which cause tick borne diseases in livestock but this reason is generally discounted because ticks persist in areas which are frequently burnt. However, Stampa (1959), in a study of the Karroo Paralysis Tick in the Karroid *Merxmuellera* Mountain Veld in South Africa, has shown that this parasite can be successfully controlled by altering the micro-climate at soil level and thereby creating an unfavourable habitat for this organism resulting in its disappearance. Similar evidence has been obtained by Trollope & Trollope (2001) in the Ngorongoro Crater and Serengeti grasslands in Tanzania where controlled burning by nomadic Masaai pastoralists has resulted in a significantly lower incidence of ticks where this practice is applied. The incidence of ticks can be high when the grass sward is in a moribund and unacceptable condition for grazing by livestock or when it is encroached by excessive densities of trees and shrubs. Therefore using fire for the aforementioned permissible reasons will have the added benefit of minimizing the incidence of ticks in areas used for livestock husbandry.

Finally it was shown that frequent fires favour the abundance of the highly productive and palatable grass species, *Themeda triandra* in southern African grasslands (Scott, 1970; Dillon, 1980; Forbes & Trollope, 1990). This raises the possibility of using fire to improve range condition by increasing the abundance of valuable forage species like *Themeda triandra*. Inadequate information is currently available to legitimise this reason for prescribed burning veld but with appropriate research on the response of key forage species to fire it could be considered as a valid reason for burning rangeland in the future.

Ecological Criteria for Prescribed Burning

The necessity for rangeland to be burnt or not depends upon its ecological status and physical condition. Generally the condition of the grass sward determines whether rangeland should be considered for burning as this component of the vegetation reflects the ecological status of the ecosystem and the presence of or its ability to produce adequate grass fuel to carry and support a fire. Quantitative techniques have been developed to assess the condition of the grass sward in relation to prescribed burning. The first technique involves determining the condition of the grass sward in terms of its botanical composition, ecological status and basal cover and involves classifying the different grass species into different ecological categories according to their reaction to a grazing gradient i.e. from high to low grazing intensities as follows:

DECREASER SPECIES - Grass & herbaceous species which decrease when rangeland is under or over grazed;

INCREASER I SPECIES - Grass & herbaceous species which increase when rangeland is under grazed;

INCREASER II SPECIES - Grass & herbaceous species which increase when rangeland is over grazed.

Simplified techniques based on key grass species that have a highly significant effect on the potential of the grass sward to produce grass fuel, have been developed in southern and east Africa (Trollope, 1983; Trollope & Potgieter, 1986; Trollope & Trollope, 1999; Trollope *et. al.*2000). Using these techniques criteria have been developed and successfully used to decide whether rangeland in a particular condition should be considered for burning or not.

The second technique involves estimating the grass fuel load using the Disc Pasture Meter developed by Bransby and Tainton (1977) and illustrated in Figure 13.1.

Figure 13.1: The Disc Pasture Meter developed by Bransby & Tainton (1977) used to estimate the standing crop of herbaceous plant material in a grass sward.

This technique involves relating the settling height of an aluminum disc dropped onto the grass sward to the standing crop of grass holding up the disc, expressed in kilograms per hectare. There is a simple relationship between the settling height and the standing crop of grass based on the fact that the more grass there is the higher off the ground the disc settles. This instrument has been successfully calibrated for much of the grasslands and savannas in southern and east Africa and research and field experience indicates that the calibration developed in the Kruger National Park (Trollope & Potgieter, 1986) in South Africa can be used as a general calibration for estimating grass fuel loads for management purposes in these regions of Africa (Trollope *et. al*. 2000).

The calibration equation is:

$$\mathbf{y = -3019 + 2260 \sqrt{x}}$$

Where: y = mean fuel load - kg/ha;
x = mean disc height of 100 readings - cm.

The physical relationship between mean disc height and the mean grass fuel load described by this calibration equation is presented in Table 13.1.

Table 13.1: Calibration for the Disc Pasture Meter developed in the Kruger National Park in South Africa and recommended for use in estimating the grass fuel load in African grasslands and savannas for management purposes (Trollope & Potgieter, 1986).

X	Y	X	Y	X	Y	X	Y	X	Y	X	Y	X	Y	X	Y
cm	Kg/ha	cm	kg/ha	cm	kg/ha	cm	kg/ha	cm	kg/ha	cm	kg/ha	cm	kg/ha	cm	kg/ha
2.0	177	6.0	2517	10.0	4128	14.0	5437	18.0	6569	22.0	7581	26.0	8505	30.0	9360
2.1	256	6.1	2563	10.1	4163	14.1	5467	18.1	6596	22.1	7605	26.1	8527	30.1	9380
2.2	333	6.2	2608	10.2	4199	14.2	5497	18.2	6622	22.2	7629	26.2	8549	30.2	9401
2.3	408	6.3	2654	10.3	4234	14.3	5527	18.3	6649	22.3	7653	26.3	8571	30.3	9421
2.4	482	6.4	2698	10.4	4269	14.4	5557	18.4	6675	22.4	7677	26.4	8593	30.4	9442
2.5	554	6.5	2743	10.5	4304	14.5	5587	18.5	6702	22.5	7701	26.5	8615	30.5	9462
2.6	625	6.6	2787	10.6	4339	14.6	5616	18.6	6728	22.6	7725	26.6	8637	30.6	9483
2.7	695	6.7	2831	10.7	4374	14.7	5646	18.7	6754	22.7	7749	26.7	8659	30.7	9503
2.8	763	6.8	2874	10.8	4408	14.8	5675	18.8	6780	22.8	7772	26.8	8681	30.8	9523
2.9	830	6.9	2918	10.9	4442	14.9	5705	18.9	6806	22.9	7796	26.9	8703	30.9	9544
3.0	895	7.0	2960	11.0	4477	15.0	5734	19.0	6832	23.0	7820	27.0	8724	31.0	9564
3.1	960	7.1	3003	11.1	4511	15.1	5763	19.1	6858	23.1	7843	27.1	8746	31.1	9584
3.2	1024	7.2	3045	11.2	4544	15.2	5792	19.2	6884	23.2	7867	27.2	8768	31.2	9605
3.3	1086	7.3	3087	11.3	4578	15.3	5821	19.3	6910	23.3	7890	27.3	8789	31.3	9625
3.4	1148	7.4	3129	11.4	4612	15.4	5850	19.4	6935	23.4	7913	27.4	8811	31.4	9645
3.5	1209	7.5	3170	11.5	4645	15.5	5879	19.5	6961	23.5	7937	27.5	8833	31.5	9665
3.6	1269	7.6	3211	11.6	4678	15.6	5907	19.6	6986	23.6	7960	27.6	8854	31.6	9685
3.7	1328	7.7	3252	11.7	4711	15.7	5936	19.7	7012	23.7	7983	27.7	8876		
3.8	1387	7.8	3293	11.8	4744	15.8	5964	19.8	7037	23.8	8006	27.8	8897		
3.9	1444	7.9	3333	11.9	4777	15.9	5993	19.9	7063	23.9	8030	27.9	8918		
4.0	1501	8.0	3373	12.0	4810	16.0	6021	20.0	7088	24.0	8053	28.0	8940		
4.1	1557	8.1	3413	12.1	4842	16.1	6049	20.1	7113	24.1	8076	28.1	8961		
4.2	1613	8.2	3453	12.2	4875	16.2	6077	20.2	7138	24.2	8099	28.2	8982		
4.3	1667	8.3	3492	12.3	4907	16.3	6105	20.3	7164	24.3	8122	28.3	9004		
4.4	1722	8.4	3531	12.4	4939	16.4	6133	20.4	7189	24.4	8145	28.4	9025		
4.5	1775	8.5	3570	12.5	4971	16.5	6161	20.5	7214	24.5	8167	28.5	9046		
4.6	1828	8.6	3609	12.6	5003	16.6	6189	20.6	7239	24.6	8190	28.6	9067		
4.7	1881	8.7	3647	12.7	5035	16.7	6217	20.7	7263	24.7	8213	28.7	9088		
4.8	1932	8.8	3685	12.8	5067	16.8	6244	20.8	7288	24.8	8236	28.8	9109		
4.9	1984	8.9	3723	12.9	5098	16.9	6272	20.9	7313	24.9	8258	28.9	9130		
5.0	2035	9.0	3761	13.0	5130	17.0	6299	21.0	7338	25.0	8281	29.0	9151		
5.1	2085	9.1	3799	13.1	5161	17.1	6327	21.1	7362	25.1	8304	29.1	9172		
5.2	2135	9.2	3836	13.2	5192	17.2	6354	21.2	7387	25.2	8326	29.2	9193		
5.3	2184	9.3	3873	13.3	5223	17.3	6381	21.3	7411	25.3	8349	29.3	9214		
5.4	2233	9.4	3910	13.4	5254	17.4	6408	21.4	7436	25.4	8371	29.4	9235		
5.5	2281	9.5	3947	13.5	5285	17.5	6435	21.5	7460	25.5	8393	29.5	9256		
5.6	2329	9.6	3983	13.6	5315	17.6	6462	21.6	7485	25.6	8416	29.6	9277		
5.7	2377	9.7	4020	13.7	5346	17.7	6489	21.7	7509	25.7	8438	29.7	9297		
5.8	2424	9.8	4056	13.8	5377	17.8	6516	21.8	7533	25.8	8460	29.8	9318		
5.9	2471	9.9	4092	13.9	5407	17.9	6543	21.9	7557	25.9	8483	29.9	9339		

The criteria that can be used to objectively decide whether rangeland needs to be burnt or not when grazed by domestic livestock are that prescribed burning should not be applied if the grass sward is in a pioneer condition dominated by Increaser II grass species caused by overgrazing. Burning is generally not recommended when rangeland is in this condition in order to enable it to develop to a more productive stage dominated by Decreaser grass species. Conversely when the grass sward is in an under grazed condition dominated by Increaser I species, it needs to be burnt to increase the better fire adapted and more productive Decreaser grass species. Finally controlled burning is necessary when the grass sward has become overgrown and moribund as a result of excessive self-shading. These conditions develop when the standing crop of grass is generally $\geq$4000 kg/ha and can be estimated with the Disc Pasture Meter. The criteria used for deciding whether to burn to control or prevent the encroachment of undesirable plants involves the same ecological criteria describing the condition of the grass sward.

However, the grass fuel loads required for prescribed burning will differ depending on the encroaching plant species. An example of the form used to interpret the results of the range assessment technique based on key grass species and the estimates of the grass fuel load using the Disc Pasture Meter is presented in Table 13.2 for the Lowveld region of the Mpumalanga & Limpopo Provinces in South Africa (Trollope, Potgieter & Zambatis, 1989). As mentioned previously, similar simplified techniques have been developed in the Eastern Cape Province in South Africa (Willis & Trollope, 1987), the East Caprivi region of Namibia (Trollope *et. al.* 2000) and the central highlands of Kenya (Trollope & Trollope, 1999).

Table 13.2: Key grass species technique for assessing the condition of the grass sward for prescribed burning in the Lowveld region of the Mpumalanga & Limpopo Provinces in South Africa (Trollope, Potgieter & Zambatis, 1989).

ASSESSMENT RANGE CONDITION - GRASS SWARD
Lowveld of Mpumalanga & Northern Province - South Africa

Land Type:.. **Sample Site:**................................ **Date:**……..........
Soil Type:.. **GPS:**..

CATEGORY	SPECIES	FREQUENCY %	FORAGE FACTOR	FORAGE SCORE	FUEL FACTOR	FUEL SCORE
DECREASER SPECIES	*Cenchrus ciliaris*		2		2	
	Digitaria eriantha		1		0	
	Panicum coloratum		4		3	
	Panicum maximum		7		2	
	Setaria flabellata		3		3	
	Setaria woodii		3		3	
	Themeda triandra		2		3	
DECREASER TOTAL						
INCREASER I SPECIES	*Hyparrhenia filipendula*		3		5	
	Hyperthelia dissoluta		1		7	
INCREASER I TOTAL						
	Bothriochloa radicans		-1		3	
	Eragrostis rigidior		-3		-3	
	Pogonarthria squarrosa		-1		-1	
	Schmidtia pappophoroides		0		-2	
	FORBS		-1		-4	
	Tragus berteronianus		-3		-5	
	BARE GROUND		-3		-5	
			268		389	
	ADDITIONAL SPECIES:					
	Aristida congesta					
	Enneapogon cenchroides					
	Heteropogon contortus					
	Urochloa mosambicensis					
INCREASER II TOTAL				**FORAGE SCORE**		**FUEL SCORE**
OTHERS **TOTAL**		**100.0**				

CONCLUSIONS:

FORAGE/ FUEL POTENTIAL

FORAGE/ FUEL SCORE	POTENTIAL	FORAGE tick	FUEL tick
> 500			
401-500			
301-400			
200-300			
< 200			

POTENTIAL SOIL EROSION

FACTOR	POTENTIAL EROSION		
TUFT DISTANCE	LOW	MOD	HIGH
	<5 mm	5-10 mm	>10 mm
Distance =cm			
GRASS STD CROP	LOW		HIGH
	>1500 kg/ha		<1500kg/ha
kg/ha =			
OVERALL SOIL EROSION POTENTIAL			

TREND

CATEGORY	%	UTILIZATION	tick
DECREASER			
INCREASER I			
INCREASER II			

VELD BURNING

CATEGORY	%	BURN	
		YES	NO
DECREASER			
INCREASER II			
FUEL LOAD - kg/ha =			
OVERALL DECISION TO BURN			

The following conclusions can be drawn from the results of the key grass species technique and the Disc Pasture Meter presented in Table 13.2.

Forage & Fuel Potentials: The range in the forage and fuel scores from very high (>500) to very low (<200) reflect the potential of the grass sward to produce forage for grazing domestic livestock and wild ungulates and to produce grass fuel to support a high intensity grass fire. These categories have proven to be ecologically meaningful with highly applicable practical management implications.

Trend: This refers to whether the rangeland is being moderately grazed, under grazed, selectively grazed or over grazed. The criteria used for deciding the intensity of grazing is that if the rangeland is dominated by decreaser grass species then it is being moderately grazed. If it is dominated by Increaser I grass species then it is being under grazed. If it is dominated by Increaser II grass species then it is being over grazed. Finally, if it is dominated by both Increaser I and Increaser II grass species, it is being selectively grazed.

Soil Erosion: The effect of the herbaceous vegetation on soil erosion depends upon the basal and canopy cover of the grass sward. If the basal and canopy covers are high then the potential for soil erosion is low and *vice versa*. Simple indices have been identified for these two parameters. Basal cover is satisfactorily described by recording the distance from a measuring point to the edge of the nearest grass tuft and is easily estimated in the field. The different categories of point to tuft distance reflecting low (<5 cm), moderate (5-10 cm) and high (>10 cm) potentials for soil erosion have been subjectively estimated for rangeland in different conditions in the Lowveld region of South Africa. The standing crop of grass is an excellent index of the canopy cover of the grass sward and is readily measured in the field with the Disc Pasture Meter. The different values that have been assigned to this parameter were subjectively determined based on field experience in the Kruger National Park which forms part of the Lowveld region.

Controlled Burning: As indicated previously prescribed burning will be recommended if the assessment of range condition indicates that the grass sward is not in a pioneer condition dominated by Increaser II grass species and the grass fuel load is ≥4000 kg/ha (Trollope, 1989).

Fire regime

The fire regime to be used in prescribed burning refers to the type and intensity of fire and the season and frequency of burning.

Type of Fire

It is recommended that fires burning with the wind either as surface head fires in grassland or a combination of surface head fires and crown fires in tree and shrub vegetation. be used in prescribed burning because they cause least damage to the grass sward but can cause maximum damage to woody vegetation if required (Trollope, 1999).

Fire intensity

Research on fire behaviour in the Eastern Cape Province and Kruger National Park in South Africa has shown that fire can be classified into the following categories according to fire intensity (Trollope, 1983; Trollope and Potgieter, 1985).

Fire Intensity(kJ/s/m)	Description
<500	Very cool
501 - 1000	Cool
1001 - 2000	Moderately hot
2001 - 3000	Hot
>3000	Extremely hot

When burning to remove moribund and/or unacceptable grass material a cool fire of <1000 kJ/s/m is recommended. This can be achieved by burning when the air temperature is <20°C and the relative humidity >50 %. When burning to control undesirable plants like encroaching bush, a hot fire of >2000 kJ/s/m is necessary. This can be achieved when the grass fuel load is >4000 kg/ha, the air temperature is >25°C and the relative humidity < 30 %. This will cause a significant topkill of stems and branches of bush species up to a height of 3 m. In all cases the wind speed should not exceed 20 km/h.

Season of Burning

Research in southern Africa has clearly indicated that that the least damage is caused to the grass sward if prescribed burning is applied when the grass is dormant. Therefore it is recommended that when burning to remove moribund and/or unacceptable grass material burning should preferably be applied after the first rains of >13mm at the commencement of the growing season i.e. when the grass is still dormant and the fire hazard is low. Conversely when burning to control encroaching plants burning should be applied before the first rains initiating the commencement of the growing season i.e. when the grass is very dry and dormant to ensure a high intensity fire. The actual time of the year when prescribed burning will be applied in Africa will depend upon the latitude and rainfall pattern of the region. For example in the central highlands of Kenya which receives a bi-modal rainfall the main burning windows are the dry period between May and September and a shorter period during January and February (Trollope & Trollope, 1999). Conversely in the summer rainfall areas of southern Africa the recommended season of burning is approximately before and immediately after the first spring rains in September/ October (Trollope, 1999).

Frequency of Burning

When burning to remove moribund and/or unacceptable grass material the frequency of burning will depend upon the accumulation rate of excess grass litter (Trollope, 1999). Field experience indicates that this should not exceed 4000 kg/ha and therefore the frequency of burning should be based on the rate at which this phytomass of grass material accumulates. This approach has the advantage that the frequency of burning is related to the stocking rate of grazers and to the amount of rainfall the area receives. Generally in high rainfall areas (>700 mm p.a.) this will result in the frequency of burning being every 2 - 4 years. In lower rainfall areas the frequency will be much lower and in fact the threshold of a grass fuel load >4000 kg/ha will generally exclude fire in these regions particularly where the condition of the rangeland is degraded and excessive grass fuel loads never accumulate.

Post -Fire Range Management

It is recommended that when burning to remove moribund and/or unacceptable grass material grazing be applied as soon as possible after the burn to take advantage of the highly nutritious regrowth of the grass plants. There is a lack of clarity as to whether rotational or continuous grazing should be applied after the fire. However there is complete consensus amongst rangeland scientists on the necessity of applying a rotational resting system when prescribed burning is used (Zacharias, 1994; Kirkman, 2001). This involves withdrawing a portion of the rangeland from grazing for an extended period of at least a growing season or longer (6-12 months) to maintain the vigour of the grass sward and enable seed production to occur for plant recruitment. The rest period is applied during the season prior to the prescribed burn. In terms of rotational grazing after a burn great success has been obtained with the "open camp system" developed by Dr A. Venter and Mr R. Drewes in KwaZulu Natal in South Africa. This involves burning a camp and grazing it as soon as possible after the fire after which the livestock are moved rotationally to other camps until such time as the burnt camp is ready to be grazed again. By following this procedure the burnt rangeland is maintained in a palatable and nutritious condition for as long as possible after the burn to the benefit of the livestock. The same procedure is then followed in subsequent years. This system presupposes the availability of adequate camps to apply this form of grazing management. In situations where there are few grazing camps available emphasis must be given to applying a rotational resting system. Where there are no camps as occurs in communal grazing areas like the Transkei in South Africa or the Ngorongoro Conservation area in Tanzania large enough areas need to be burnt to avoid overutilization of the burnt area. This practice will also *de facto* result in a resting treatment being applied to the unburnt area which is initially less attractive to grazing animals.

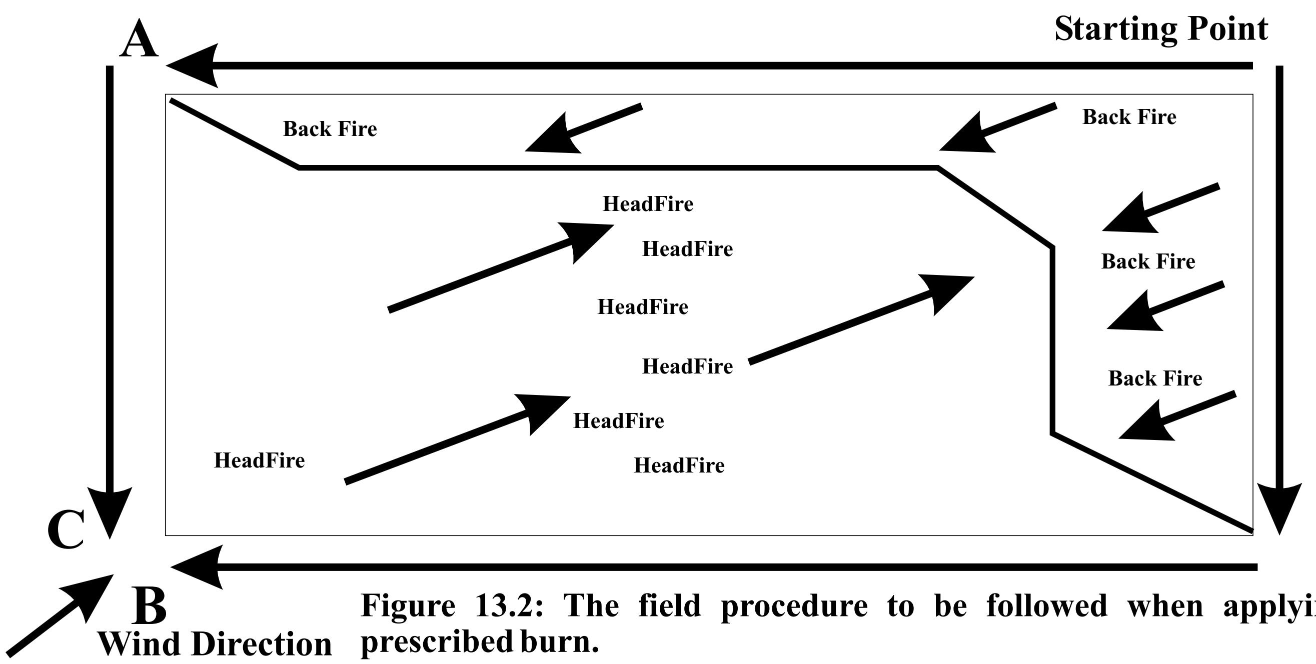


Figure 13.2: The field procedure to be followed when applying a prescribed burn.

Practical Application of a Prescribed Burning Program

Burning procedure

The procedure to be followed when burning a camp is illustrated in Figure 13.2.

The field procedure illustrated in Figure 13.2 comprises the following steps:

- Initiate simultaneously two surface back fires burning against the wind along two lines commencing at the starting point and proceeding to corners A and B of the camp. The resultant back fire will be a slow moving burn characterised by low flames and relatively easy to control;
- Allow the back fires to burn back until an adequate fire break has been established;

Initiate a surface head fire burning with the wind, by proceeding from points A and B to point C simultaneously and as swiftly as possible. The resultant head fire will be a fast moving burn characterised by high flames that on meeting the back fire will cause both flaming fronts to assume a vertical angle thereby preventing the fire from spreading further.

This method of applying a prescribed burn is the standard procedure that is used by field operators involved in extensive land management and greatly reduces the risk of losing control of prescribed burns.

Firebreaks

As a fundamental general rule prescribed burning must not be applied without adequate firebreaks having been prepared prior to initiating a burn. The lack of effective firebreaks is one of the most important reasons for fires getting out of control during the application of a prescribed burn. Furthermore the practice of combining the burning of a camp with the simultaneous burning of a firebreak is very dangerous and must be avoided. The reason is that if the wind direction changes it is not readily possible to apply a back fire to contain the already initiated fire front.

There are basically two types of firebreaks viz., clean cultivated and burnt firebreaks.

Clean Cultivated Firebreaks

These comprise destroying and removing the ground layer vegetation either manually or mechanically. This is the most effective type of firebreak but it has certain disadvantages:

- When manually executed it is labour demanding and expensive;
- When mechanically executed with a tractor it is only possible in relatively flat terrain and is expensive;
- By exposing the soil surface and destroying the vegetal cover there is an increased potential for accelerated soil erosion but this is dependent upon soil type and topography;

Burnt Firebreaks

These comprise creating a burnt strip of vegetation around the perimeter of the camp. Burnt firebreaks are constructed in several ways. The most common method is to burn a strip of grass with the aid of fire fighting equipment. The advantages of this method are:

- It requires a minimum of equipment;
- It requires no preparation.

The disadvantages of this method are:

- It is dangerous;
- It is slow;
- It is labour demanding and expensive.

A very effective method is to first cut two strips with a mower, leaving an uncut strip in the centre which is then burnt. The advantages are:

- It is relatively safe because the cut portions reduce the intensity of the fire, making the fire easier to control;
- It is a rapid method;
- It is less labour demanding and expensive.

The disadvantages are:

- It is limited to areas with a gentle topography;
- It requires preparation in the form of mechanical mowing, which is expensive.

A similar method to the previous type of firebreak is to spray two strips of the grass sward around the perimeter of the area to be burnt with a foliar weedicide towards the end of the growing season and then to burn the strips when the grass becomes dry. The unsprayed portion between the spayed strips is then burnt during the dormant season when the grass is dry and flammable. The advantages of this method are:

- It is relatively safe;
- It is not labour demanding.

The disadvantages of the method are:

- It is a time consuming method involving several discontinuous operations;
- It is expensive;
- The weedicide treatment can destroy the grass leading to bare areas and accelerated soil erosion.

The *Botha Fire-Box* method

This comprises constructing an open box-like structure with four sheets of corrugated iron fitted with four wooden handles (see Figure 13.3).

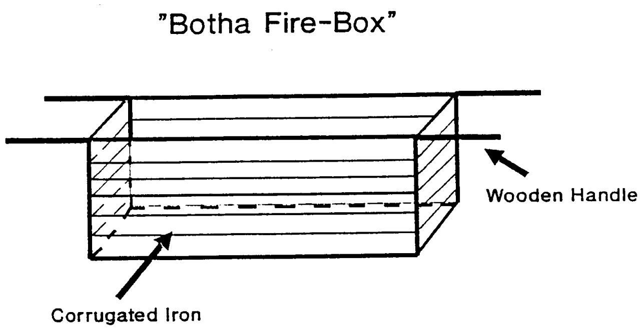


Figure 13.3: A *Botha Fire-Box* comprising four sheets of corrugated iron fitted with four wooden handles.

The grass material is set alight around the inside perimeter of the "fire-box" causing a vortex of hot air to rise resulting in a hot, clean burn. At the completion of the burn the "fire-box" is moved forward and the same process repeated. The advantages of this method are:

- It permits burning under extremely windy conditions;
- It is labour efficient;
- The fire-box is very easy and inexpensive to construct;
- It is well suited to broken topography and stony terrain.

The disadvantage of this method is that it is slow in comparison to the other burning techniques, but this is offset by the greater degree of safety. It is also quicker than manually constructed clean cultivated firebreaks.

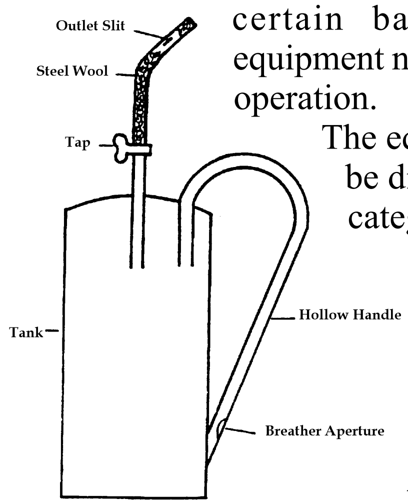
Width of Firebreak

It is not possible to state how wide a firebreak should be because its effectiveness is influenced by factors such as topography, the intensity of the fire and the velocity of the wind. Furthermore it must be appreciated that the role of a firebreak is to provide a safe point from which to lay a line of fire and not to check the advance of a rapidly moving fire front. Therefore, based on this principle the firebreak need only be wide enough to contain the flames during the application of the back fire during the initial stages of applying a prescribed burn. This is because when the head fire is applied the flames are blown away from the firebreak into the area to be burnt.

Generally when burning grassland a firebreak of 2 - 3 m is adequate. However when burning highly inflammable vegetation a firebreak of 4 - 6 m is necessary.

Burning Equipment

In the application of a safe and effective prescribed burn there are certain basic items of equipment necessary for the operation.



The equipment can be divided into two categories.

Equipment for initiating the fire

Numerous techniques are used for initiating fires ranging from a match stick to maize cobs attached to a length of wire and saturated with diesel fuel. The most effective method is the "drip torch" illustrated in Figure 13.4.

Figure13.4: A drip torch used for laying fire lines.

A fuel mixture comprising two parts diesel fuel and one part petrol ($^2/_3 + ^1/_3$) is allowed to drip out of a slit type aperture at the end of the pipe. The dripping fuel is ignited and when it falls to the ground or onto vegetation it burns for approximately 20 seconds setting the vegetation alight with a continuous line of fire. The advantages of this technique are:

- a continuous line of fire can be set very rapidly, significantly reducing the time to burn a camp;
- it is very effective for swiftly laying a back fire during an emergency;

it is very effective when setting shrub vegetation alight because the flaming drops of fuel burn for a sufficient period for the shrubs to ignite.

Equipment For Containing The Fire

The minimum items required are fire swotters, water pumps and an adequate source of readily available water. These items are not used during the application of the actual burn but in the construction of the firebreaks. During the burn they are held in reserve in case of an emergency because if the correct burning procedure is followed and the firebreaks are effective, a burn should proceed without mishap. However, accidents do occur.

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Invitation to 40th Annual Congress of the Grassland Society of Southern Africa

Southern African Rangelands – widening perspectives on utilisation and management

18 – 21 JULY 2005
Kapenta Bay Hotel, Port Shepstone, KwaZulu-Natal

First Announcement and Call for Papers

PREAMBLE

The rangelands of southern Africa are under increasing pressure to provide a range of goods and services beyond forage for livestock and wildlife. Apart from the livestock and game industry, other groups or sectors are taking interest in the products of rangelands or in rangelands as a venue for tourism and other activities. These include agencies tasked with the conservation and management of biodiversity, farmers wanting to establish crops or timber species in former grassland areas, and those wanting to expand present urban and peri-urban areas, or create new, high-cost settlements in grassland areas.

This conference seeks to provide a forum to consider rangelands from a wide range of alternative (and often opposing) perspectives on what constitutes our 'rangelands' in terms of what they can provide and how they should best be managed to achieve particular objectives. Three main themes of the conference will revolve around the use of rangelands for:

(1) livestock and wildlife,
(2) biodiversity conservation and ecosystem function, and
(3) people and development.

For each of these user perspectives, critical consideration will be given to aspects of assessment, management, policy development, tools for rehabilitating rangelands to achieve a particular objective, and, perhaps most critically, strategies for managing rangelands to achieve multiple