



THE USE OF FIRE IN THE KWAZULU-NATAL MISTBELT AND HIGHLAND SOURVELD

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Grasslands are dominated by perennial plants that can withstand fire, drought, frost and inappropriate grazing in moderation. Undesirable changes to the grasses can occur (for example changes in vigour, species composition, productivity and increase in abundance of the tree component) when fire, drought, frost and grazing occur too frequently or not at all.

There are numerous management tools at a farmer's disposal, of which rest, fire and grazing are the most influential. Factors that are important for veld composition and functioning are fire, grazing, climate and soils (Short, 2010). The interactive effects of these factors can have a significant effect on animal performance, veld condition, bush thickening and encroachment.

High rainfall (mesic) grasslands are referred to as fire-climax grasslands (Acocks, 1988) as without the occurrence of fire, these grasslands would progress to a woody state (Fynn, 2003). *Themeda triandra* is an indicator of veld in good condition in a fire-climax grassland (Hardy & Hurt, 1989) when occurring in abundance. Frequency of the use of fire affects species composition, cover and herbage production of the grass sward (Short, 2010).

According to Trollope (2002) the factors that affect the behaviour of a fire are:

- fuel characteristics, fuel load, fuel distribution, fuel compaction and fuel moisture;
- air temperature;

- relative humidity;
- wind; and
- slope.

These factors affect the availability of heat energy, the rate at which heat energy is released and the vertical distribution of the heat energy, which will determine the nature of the fire. Generally, headburns (with the wind) are more intense fires and have the greatest effect on trees, with the least effect on grasses (Trollope, 2002). Backburns (against the wind) are more intense at ground level and do more damage to the grass plants (Trollope, 2002), thereby suppressing regrowth. Fire frequency, fire intensity and season of burn are three critical factors that can be manipulated by the manager. The decision on when and how to burn should be based on a set of management objectives and a sound ecological knowledge. The final decision should be based on seasonal rainfall, veld condition and available biomass.

Why use fire?

Fire can be used to remove excess / ungrazed herbage, to control bush encroachment and for firebreaks. Access to light is important in mesic grasslands, therefore shading out by moribund (at the point of dying) material is detrimental to the survival of certain grasses. The defoliation of moribund material (through the use of fire) will stimulate tillering (Mentis *et al.*, 1984; Short, 2010), which results in a more even utilisation of the grassland during that growing season.

Fire creates a more homogeneous grazing environment and thereby alters grazing patterns (Acrhibald & Bond, 2003). Since regrowth in the season following a fire is more nutritious than subsequent seasons without burning (Mentis *et al.*, 1984), improved animal performance levels may be expected. Mesic grasslands are fire-prone and fire-dependant therefore needing fire in order to maintain biodiversity (Lechmere-Oertel, 2014). Fire is therefore necessary in these grasslands to maintain the health of the grassland. Withholding or removing fire from a mesic grasslands can result in a shift towards a woody and often weedy component. Withholding fire as well as excessive use of fire can be problematic.

When to burn

Burning should be done in accordance with the local Farmers' Associations guidelines. The decision to burn should be based on seasonal rainfall and the availability of readily available grass (biomass). Mesic grasslands should be burnt between late winter and early spring. Burning to remove moribund material should be done with a cool head fire in the early mornings or late afternoon, or after a light rain (to reduce the intensity of the fire).

The goal is to have a patchy burn that leaves the mulch layer unburnt (Lechmere-Oertel, 2014). Regrowth of grasses is stimulated by temperature and day length, so burning when grasses are dormant (not actively growing) doesn't damage the growth points of the grasses. Veld should have a full growing seasons rest prior to a burn, in order to build up sufficient fuel load. Burning should be done between winter (May/June) and spring (September/October) (Everson & Everson, 2016).

Seasonal variations in temperature and rainfall have an effect on plant growth, therefore it is important to take the season into consideration when deciding when to burn, in order not to damage the plant growth points.

For recommended burning regimes, refer to the Bioresource Program recommendations for the 590 agro-ecological zones in KwaZulu-Natal.

When not to burn

The season the burn is applied is of critical importance. The manager needs to ensure the growing point of the grass is low-lying to ensure it isn't damaged by the intended fire. Late growing season fires reduce grass production and result in an increase in forbs (Kirkman & Morris, 1999; Tainton & Mentis, 1984). Autumn burns (burning for a "green bite") reduces diversity and basal cover (Tainton & Mentis, 1984) and leaves the grassland prone to soil erosion, soil capping and loss of soil moisture.

Frequency of burn

For mesic grasslands, a burn should be implemented every two to five years, depending on conditions, biomass, grazing and resting regime and veld condition. A higher burning frequency destroys the natural pollinators of mesic grasslands (Lechmere-Oertel, 2014). Coastal grasslands can be burnt more frequently since they experience higher growth rates than mesic grasslands (Lechmere-Oertel, 2014). The drier the climate, the longer the interval between burns needs to be (Lechmere-Oertel, 2014). Excluding fire from veld in the long-term reduces production and grass quality (Everson & Everson, 2016).

Advantages of using fire

Burnt grasslands have improved livestock production (and in particular, sheep production), while performance on unburnt veld is significantly lower (Kirkman & Morris, 1999; Lechmere-Oertel, 2014). Removal of dead or undesirable material is likely to result in more uniform grazing post-burn (Kirkman & Morris, 1999; Lechmere-Oertel, 2014). The use of fire in mesic grasslands can help suppress woody plants, provided it is used under very specific conditions (Lechmere-Oertel, 2014).

Conditions suitable for controlling bush encroachment are: dry vegetation with a fuel load exceeding 4 000 kg/ha; air temperature >25°C; relative humidity <30%; moderate wind (<20 kg/hour) and woody plants should be actively growing (Trollope, 2003). Good firebreaks and extra personnel and equipment should be on hand.

Disadvantages of burning

Herbage production in the season following a burn is lower, relative to unburnt veld (Tainton *et al.*, 1977). Without careful planning and implementation, the use of fire as a management tool may fail over the long term, since regular disturbances (and over-application) can result in a spread of alien plants (Wolfson, 2003), thereby decreasing the veld condition and the quality of the herbage on offer to livestock. A high frequency of burning results in decreased species diversity (Kirkman & Morris, 1999), which reduces the stability of the ecosystem. In addition, exposed soils are more prone to soil crusting (Mills & Fey, 2004). An inappropriate burning regime (too frequent) will result in a shift from palatable to unpalatable species (Everson & Everson, 2016), which can ultimately result in a loss of basal cover leaving the soil prone to erosion. This in turn puts extra pressure on the remaining grass, thereby aggravating the cycle. A too-infrequent burning regime can be very detrimental to a mesic grassland as it leads to a moribund state (Lechmere-Oertel, 2014).

Post-burn management

Match stocking densities to those recommended for your area (refer extension personnel), and implement a short period of occupation (a quick rotation) with adequate periods of absence to allow the grass time to recover. It is important that non-selective grazing is practised, without over-grazing the veld. Sufficient time after grazing should be allowed for the veld to build up food reserves and maintain vigour. Consult extension personnel for detailed recommendations.

What are the legal implications?

The use of fire is legally regulated in South Africa. There are implications for negligence. The National Veld and Forest Act No 101 of 1998, legislates the formation of a Fire Protection Association in addition to the burning of firebreaks on an annual basis (www.daff.gov.za). Farmers' Associations require a fire management plan approved by the local Fire Protection Association. The Conservation of Agricultural Resources Act 43 of 1983 (CARA) makes it a legal obligation to control invasive alien vegetation on a farmers unit. CARA also legalizes the rehabilitation of natural veld (www.daff.gov.za).

Monitoring the changes in veld

Any changes in fire and grazing management that promotes a more stable and resilient ecosystem will better support livelihoods, livestock production and biodiversity (Lechmere-Oertel, 2014). Assessing the impact of the applied management strategy is an important factor for decision making. The manager needs to evaluate whether the change in fire management or the addition of fire will have a positive effect on biodiversity and productivity. Frequent veld condition assessments will help with monitoring changes in the vegetation. Veld management should be an adaptive-management style (Danckwerts *et al.*, 1993) and is a fine balance between managing for the needs of the livestock and managing for biodiversity. The changes in the veld will ultimately inform the manager as to whether he is implementing the correct management strategy or not.

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