

Unplanned fires and sustainability of a semi-arid rangeland in South Africa

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Introduction Whether due to lightning or human negligence, large-scale unplanned fires affect large areas of the semi-arid southern African rangelands during the dormant winter (June-August) period (Everson 1999). These fires cause enormous fodder flow problems, and also influence ecosystem functioning (Snyman 2003). The short-term impact (2 years) of an unplanned fire on the sensitivity of above- and belowground productivity of a semi-arid rangeland was therefore investigated.

Materials and methods The research was conducted in a semi-arid summer rainfall region of South Africa (30° 15'S, 27° 10'E, altitude 1652 m). Annual rainfall is 623 mm of which 65% occurs from November to March. The study area is situated in the moist, cool Highveld grassland and consisted of a dense sward of perennial grasses such as *Cymbopogon plurinodes*, *Themeda triandra*, *Digitaria eriantha* and *Elionurus muticus*. Soils in the study area are mostly fine sandy loams. The burning treatment was a single accidental wind-driven head fire. The research was conducted on six plots of 10x10 m² each, half of them set out on the burnt and half on unburnt patches. All plots were excluded from livestock grazing for the 2-year (2001/02 to 2002/03) trial period. Basal cover was determined with a bridge-point apparatus every 4 months. Regrowth was determined at the end of each growing season (April) by clipping all grasses to a height of 30 mm in eight randomly selected quadrats of 1m² each. Root weight was obtained by extracting root cores with a soil drill (70 mm diameter), at 50 mm depth intervals to a total depth of 600 mm. Roots were removed by washing through a 2.0 mm sieve each of 20 cores randomly selected/plot. One-way analyses of variance at 95% confidence level was computed for basal cover, above- and belowground production.

Results and discussion At 4 and 2 months after the fire, basal cover for all species in the burnt area averaged 40 and 18% less, respectively, than that in unburnt rangeland (P<0.01). *C. plurinodes* and *E. muticus* tufts had the greatest fire damage, while *E. chloromelas*, *D. eriantha* and *T. triandra* were less badly affected. In the first season after the fire, total seasonal production from the burnt rangeland was 1268 kg/ha less than from the unburnt area, 1452 versus 2720 kg/ha, respectively (P<0.01). Two years after the fire, production from burnt and unburnt rangeland differed by only 109 kg/ha (P>0.05). Root weight declined most, by as much as 57%, over the first 100 mm depth (P<0.01). For the two growing seasons, root weight decreased with depth for both the burnt and unburnt rangeland (P<0.01). Root weight increased in the burnt rangeland over all depths for the second season following the fire and was lower (P<0.01) than that of unburnt rangeland only in the first 50 mm depth class. The top 0-300 mm soil layer, which is mostly responsible for production, had 89% of the root weight averaged for the two seasons for unburnt rangeland. The root/shoot ratio decreased (P<0.01) with burning over the first season after the fire from 1.46 to 1.20. The decrease in aboveground phytomass due to burning for the first and second growing seasons was 1268 and 109 kg/ha, respectively, compared to the 1757 and 402 kg/ha decrease respectively of root weight.

Conclusions Accidental or unplanned fires contribute towards anthropogenic droughts in semi-arid areas, and therefore influence the short-term sustainability of rangeland ecosystems. Belowground growth is more sensitive to burning than aboveground growth. These results can serve as scientific guidelines in claims for damages and short-term risk management of semi-arid rangelands after accidental fires.

References

- Everson C.S. (1999). Veld burning in different vegetation types. In: N.M. Tainton (ed.) Veld management in South Africa. University of Natal Press, Pietermaritzburg, South Africa, 228-235.
- Snyman H.A. (2003). Fire and the dynamics of semi-arid grassland; influence on plant survival, productivity and water-use efficiency. *African Journal of Range and Forage Science*, 20, 29-39.