

Long-term effects of burning on woody plant species sprouting on the False thornveld of Eastern Cape

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Introduction

Sprouting allows woody plant species to persist in a site after a wide range of disturbances (e.g. prolonged fire), where opportunities for seedling establishment are limited. Everham and Brokaw (1996), Reich et al. (2003), Vesk and Westoby (2004) and Paciorek et al. (2000) have noted that the effect of fire on sprouting of woody plant species could be affected by a number of environmental factors. A study to investigate long-term effects of fire on sprouting of woody species was conducted at Honeydale section of the University of Fort Hare Research Farm.

Materials and methods

Study area, experimental description and measurements

The farm is located at 32° 47' S and 26° 52' E with an elevation of 517.9 m asl on the False thornveld of Eastern Cape. The area has undulating terrain dominated by Eastern Thorn Bushveld. The climate is semi-arid with about 480mm annual rainfall, most of which occurs in summer, the annual average temperature is 18.7°C. The study consisted of six burn treatments (No-burn, 1-year, 2-year, 3-year, 4-year and 6-year burn) replicated twice. Number of sprouts for woody plant species was obtained by counting sprout of plants within 15m by 15m quadrats. Three quadrats were established in each 0.5ha plot.

Statistical analysis

Treatment effects were assessed with ANOVA using the GLM Procedure of SPSS at 5% level of signifi-

cance. Difference between the treatments means ($p = 0.05$) were separated using LSD.

Results

The results demonstrated significant difference ($p \leq 0.05$) in number of sprouts produced by woody species as a consequence of different fire frequencies (Table 1). *Acacia karroo* produced significantly highest number of sprouts in 1-year than in other burn treatments (Table 1). The second highest number of sprouts for *A. karroo* was obtained under 3-year burn; however this was not significant when compared with number of sprouts recorded under 2-year. The lowest mean number of sprouts obtained under no-burn treatment for this species was not significant when compared to values in 4-year and 6-year (Table 1). *Asparagus* species recorded highest mean number of sprouts (10.33) under 3-year burn; however, this was not significant when compared to values obtained under 1-year, 2-year and 4-year (Table 1). Lowest mean number of sprouts (3.75) for this species was recorded under 6-year burn; however, this figure was not significant when compared to the figure obtained under 4-year. *Diospyros lycioides* produced highest number of sprouts under 3-year burn and lowest under 6-year, however, this figures were not significant compared to those obtained in other burn treatments.

Ehretia rigida recorded more sprouts under 4-year burn than in other burn treatments and lowest under 3-year (Table 1). Highest number of sprouts

for this species was significant only when compared to the value obtained in 6-year burn while lowest value was significant when compared to values in 1-year, 2-year, and 4-year. The number of sprouts for *E. rigida* produced under no burn, 6-year and 3-year were not significantly different. The number of sprouts for *L. ferocissimum* in no burn, 4-year, 6-year and 3-year did not have enough replicate for statistical comparisons. *Opuntia* species did not produce enough number of sprouts in no-burn, 4-year, 6-year and 3-year for statistical comparisons.

Portulacaria afra produced highest number of sprouts under 3-year and lowest under no burn treatments. Highest number of sprouts for *P. afra* species was significantly higher when compared to figures recorded under 1-year, no burn and 6-year burns while lowest value (1.25) was significant when compared to the figure recorded under 3-year.

Discussions

Different burning frequencies did not lower the sprouting potential of tree species but either promoted more sprouts or did not have a clear effect. Short burning intervals (1-year, 2-year and 3-year) seemed to favour more sprouting in species such as *A.karoo*, *Asparagus species*, *P. afra*, *L. ferocissimum*

and *Opuntia* species. This may suggest that control of encroachment by these species cannot be easily attained by fire alone. Different burning frequencies did not exhibit clear effect on number of sprouts produced by *E.rigida*, *D. lycioides* and other species. Plant age, soil moisture at time of burn, intensity of fire, season of burn, health of the plants, and frequency of droughts play a part in how fire affects woody species in the long run (Higgins 1986b). Anderson and Bailey (1980) reported that if fire occurs before active growth has begun, increased density from sucker development could result; on the contrary, Vogl (1974) and White (1983) argues that fire will damage living tissue regardless of whether the plant is actively growing or dormant. In grasslands, most fire-adapted or fire-tolerant woody species cannot sustain large populations in grasslands subject to intense fires on a frequent basis (Glover 1972).

Woody species respond differently from fire damage, *Rosa woodsii* took 2 to 3 years to recover completely from fire damage (Monsen and Davis 1985). Leege and Hickey (1971) and Bock and Bock (1984) reported that wild rose plants sprouted after a burn and remained at the same densities as at pre-burn.

Species	1-year	2-year	No burn	4-year	6-year	3-year
<i>A. karroo</i>	2.59 ^a	1.612 ^{bcdeg}	0.11 ^{bf}	0.974 ^{bde}	0.514 ^{def}	1.946 ^{bcdg}
<i>Asparagus species</i>	7.16 ^{acd}	9.84 ^{bc}		6.69 ^{abcd}	3.75 ^{acd}	10.33 ^{bc}
<i>D. lycioides</i>	9 ^a	5.11 ^a	3.25 ^a	6 ^a	2 ^a	3 ^a
<i>E. rigida</i>	2.75 ^{abcde}	2.89 ^{abce}	1.5 ^{a bcde}	3 ^{bce}	0.6 ^{acde}	1 ^{abcde}
<i>L. ferocissimum</i>	3.455 ^a	3.909 ^a				
<i>Opuntia species</i>	0 ^a	0.14 ^a				
<i>P. afra</i>	2.33 ^{ab}	4.29 ^{abc}	1.25 ^{ab}	3.69 ^{abc}	1.85 ^{ab}	5.8 ^{bc}
Others	14.12 ^a	2.25	0.71 ^b	1.4 ^b	0 ^b	19.5 ^a

Values within each row followed by different letters are significantly different at $p \leq 0.05$ (LSD test).

Conclusions

The results of this study demonstrated that long-term fire had effects on woody species sprouting; however, discrepancies due to environmental factors are probable. Short interval burns (1-year, 2-year and 3-year) increasingly enhanced sprouting of *P. afra* and *A. karroo*. Burning did not have consistent effects on number of sprouts produced by *D. Lycioides* and *E. rigida*.

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