

Effects of frequency of rangeland fire on soil water repellency and hydrologic conductivity

By

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INTRODUCTION

- Fire is an extensively used rangeland management tool to achieve several objectives.
- However, fire is one of the key causative factors of soil water repellency,
 - through its potential to cause the build-up of a water repellent soil layer.
- This occurs via the translocation of volatilised water repellent organic compounds into the soil profile,
 - which condense in cooler soil layers and coat soil aggregates.
- The aim of the study was to determine the effects of rangeland fire frequency on soil water repellency.

OBJECTIVES

- To measure the cumulative effects of fire frequency on soil water infiltration rate (MDI)
- To estimate the cumulative effects of fire frequency on soil water repellency (WDPT)
- To establish the relationship between the soil water infiltration (MDI) and water repellency (WDPT)

MATERIALS AND METHODS

- The study was conducted at the long-term burning trials (UFH) Honeydale Farm (32° 47' S, 26° 52' E and altitude of 518 m).
- The mean annual rainfall is 500 mm
 - which 70% occurs between October and March.
- The maximum temperature ranges between 26 – 41°C and the minimum ranges from 5 – 11°C.
- The vegetation type is Bhisho Thornveld,
 - consists of grasses infrequently interspersed with *Acacia karroo*.
- The dominant herbaceous vegetation species include
 - *T. triandra*, *P. maximum* and some invasion of *D. eriantha* and *Sporobolus spp.*
 - The main karroid shrub is *C. tenuifolia*.
- The soil is silty loam of the Glenrosa form characteristically shallow with a stony surface.

EXPERIMENTAL DESIGN

- The experimental site was established in 1980 on a freshly burnt site
 - to ensure relative uniformity in vegetation and soil conditions
- The burning treatments consist of
 - annual, biennial, triennial, quadrennial, sexennial and control (no burn).
- Each treatment was laid out on a 100 m x 50 m plot with a border space of five meters between plots.
- The experiment was laid out in completely randomised design with two replicates.
- Burning of the plots takes place every August and it is preceded by a vegetation assessment exercise.
- Water Drop Penetration Time (WDPT) and Mini Disc Infiltrometer (MDI) tests were conducted at
 - six depths (0, 1, 2, 3, 4, and 5 cm)
 - on six systematically selected locations along two parallel 100 m line-transects.

STATISTICAL ANALYSIS

- WDPT and MDI results were compared between
 - annual, Biennial, triennial, quadrennial, sexennial and control
- For this comparison, data were analysed with the one way ANOVA (SPSS 1999).
- Post hoc test (LSD) was used to separate the means between the treatments
- Pearson correlation was ran to estimate the relationship between WDPT and MDI results

RESULTS AND DISCUSSION

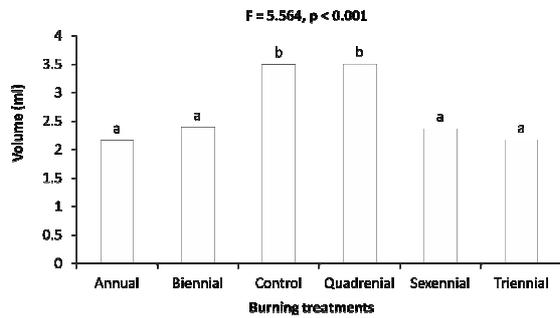


Fig 1: Effects of veld burning frequency on soil water infiltration (MDI) rate

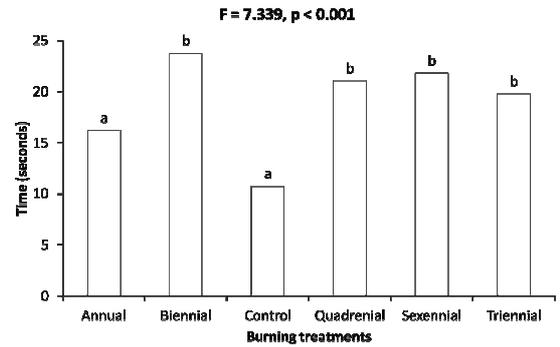


Fig 2: Effects of veld burning frequency on soil water repellency (WDPT)

- There was no significant difference ($p > 0.05$) between the soil depth (0, 1, 2, 3, 4 and 5 cm) for both MDI and WDPT
- There was a negative correlation between infiltration rate (MDI) and water repellency (WDPT) results

CONCLUSION AND RECOMMENDATIONS

- Frequency of burning had a significant effect on both infiltration and water repellency
- Annual, biennial, triennial and sexennial burning treatments had the lower infiltration rate
- The water drop penetration time for biennial, triennial, quadrennial and sexennial burn was higher than the control
- To retain high soil water infiltration rate, quadrennial burn is recommended
- There should be further research on the effects of fire on water repellency at different vegetation types
- Post burning water repellency and infiltration test should also be further researched.

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THANK YOU

