FIREGRAZE: Using strategic patch burning to influence cattle grazing behaviour and improve land condition.

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Abstract

Managing grazing distribution in large, diverse paddocks is a key challenge in the tropical rangelands of northern Australia. These landscapes consist of varying land types, ranging from fertile alluvial clays to rugged, skeletal red earths, leading to uneven grazing patterns as cattle favour areas with higher-quality forage. Overgrazing of preferred land types can degrade soil health and pasture composition, while underutilized areas contribute less to overall paddock productivity.

This study investigated whether burning underutilized areas could attract cattle and redistribute grazing pressure. Conducted at Victoria River Research Station, Northern Territory, two areas of 2.3 km² and 3.3 km² were burned. Global Navigation Satellite System (GNSS) collars tracked cattle movements across burnt and unburnt land types. There was increased cattle activity in burnt areas during the wet season following burning, with reduced grazing pressure on productive grey clays and vulnerable red earths.

The findings suggest that targeted burning can effectively redirect grazing pressure, enhancing the use of underutilized areas and promoting more sustainable land management in heterogeneous rangelands.

Introduction

The average size of a cattle station in the Victoria River District in the northwest of the Northern Territory is 3,377km² with a median paddock size of 120km² (Cowley 2014). These vast grazing lands are a mosaic of land types with unique topography, soil characteristics and pasture composition. Within paddocks, productive alluvial clay soils may sit juxtaposed with skeletal red earths, creating stark contrasts in grazing value and preference. This patchiness is both an opportunity and a challenge; while it provides diverse resources for cattle, it also leads to uneven grazing patterns as cattle instinctively favour areas with higher-quality forage (Tomkins and O'Reagain 2007).

Overuse of productive land types can lead to a decline in desirable palatable perennial pastures and soil health. At the same time, less fertile or areas further from a water source are often underutilised, reducing their contribution to overall paddock productivity. One strategic management tool to address this imbalance and improve grazing distribution across a paddock is the use of fire to stimulate regrowth in less-used areas.

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Cattle are strongly attracted to post-fire regrowth, which is high in protein and digestible energy (Reid, 2022, Andrew 1986) offering a natural and low input method to redirect grazing pressure and promote more even utilisation of the land.

This study aimed to investigate if burning less preferred, underutilised areas within a paddock can attract cattle to these areas, thereby reducing grazing pressure on more preferred areas to improve overall paddock productivity.

Methods

The study was conducted at Victoria River Research Station (VRRS), 220 km south-west of Katherine in the Victoria River District of the Northern Territory. The climate is tropical with a median rainfall of 793mm, with the majority of rain falling between October and April. The study sites were in Conkerberry paddock (17km^2) and Box paddock (21km^2). The study sites were broadly a mix of alluvial grey clays dominated by ribbon grass (*Chrysopogon fallax*) and Flemings bush (*Flemingia pauciflora*) and calcareous red earths dominated by black spear grass (*Heteropogon contortus*) and white grass (*Sehima nervosum*). Land unit mapping at 1:30,000 scale of Kidman Springs (Forster 1972) defines 5 land units consistent across both paddocks: 4a and 4b (gently undulating to flat plains with grey, brown and red clays), 5a (Gently undulating to flat plains with a mix of calcareous red earths and grey, brown and red clays), 3a, 3b and 3c (undulating plains with calcareous red earths) and 7b (creeklines). Land unit 2a (Rugged undulating terrain on limestone with shallow skeletal soils) only occurred in Box paddock and 6d (severly eroded red earths) only occurred in Conkerberry paddock.

An underutilised area in each paddock was selected for burning. In October 2022, a 2.3km^2 area of Conkerberry was burnt (12% of paddock). In October 2023 a 3.3km^2 area of Box paddock was burnt (15% of the padddock). The burnt areas were predominately 2a and 3b land unit in Box paddock and a mix of 3a, 5a and 4b in Conkerberry paddock. Land units were combined into broad land types for analysis. 4a and 4b were combined into grey clays. 5a, 2a, 3a, 3b, 3c and 6d were combined into red earths.

The paddocks were stocked to long-term carrying capacity. All cattle were fed a standard supplement of urea in the dry season and phosphorus in the wet season. Twenty GNSS collars were deployed randomly in a mob of 76 pregnant Brahman cows in Conkerberry paddock in September 2022, and 24 GNSS collars were deployed randomly in a mob of 75 pregnant Brahman cows in Box paddock in May 2023.

The collars comprised a 61mm x 89mm x 89mm IP68 rated plastic shell, with a metal, wide “U” shaped bracket bolted to the top and PVC webbing used as straps to attach around the neck of the animal. A GNSS logger inside the shell from IGotU (GT600) recorded GNSS location every 10 minutes.

GNSS loggers were downloaded at each muster (May and September). GNSS data was analysed using QGIS plug ins to calculate total GNSS pings across the paddock and within different land types. GNSS pings were converted to relative time spent to allow for comparison between land types of different sizes. A selection index for time spent per land type was calculated as the proportion of time spent in a land type / the proportion of the paddock of that land type. GNSS pings around water points were omitted where cattle were known to rest for long periods.

Repeat photo monitoring sites marked with metal pickets were established in burnt areas prior to burning. Photos were taken at the picket before and after burning and through the study period facing north, east, south and west.

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Results

There was a significant increase in animal presence within the burnt areas in both paddocks following fire once wet season rainfall occurred. The preference for the burnt areas in the wet season immediately after burning was higher in Conkerberry paddock (Fig. 1) than in Box paddock (Fig. 2). A preference for burnt areas continued throughout the wet season (November to April) in both paddocks.

The time spent on grey clays decreased during the wet season in both paddocks in both burn and no burn years, however in Conkerberry paddock cattle spent less time on the grey clays in the year burning occurred (0.7 relative time spent) compared with the following year without burning (0.9 relative time spent).

The relative time cattle spent on erodible red earths (6d) in Conkerberry paddock between November and April was significantly higher in the non-burn year (3.4 relative time spent) compared to the burn year (Fig. 3, 1.9 relative time spent).

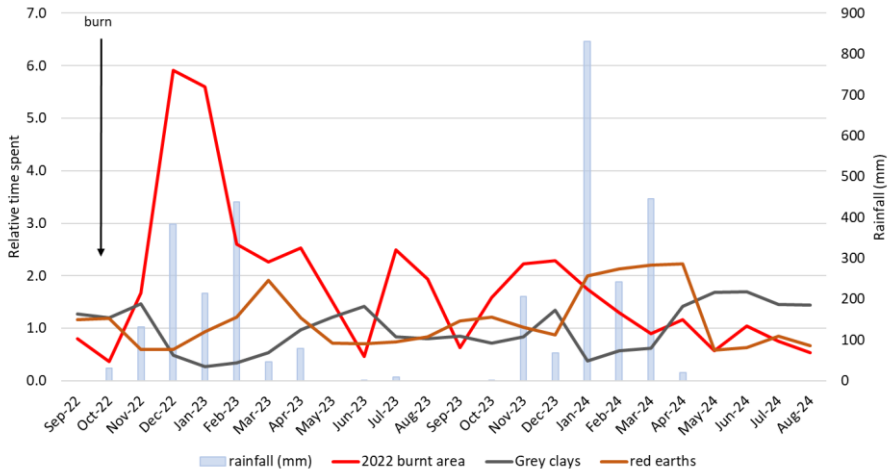

Figure 1. Relative time spent (averaged monthly) following fire on different land types and burnt areas in Conkerberry paddock

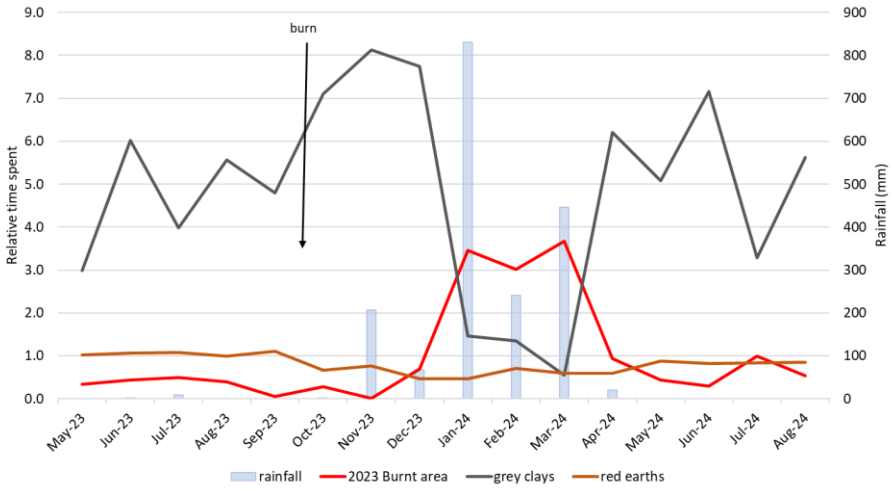

Figure 2. Relative time spent (averaged monthly) before and after fire on different land types and burnt areas in Box paddock

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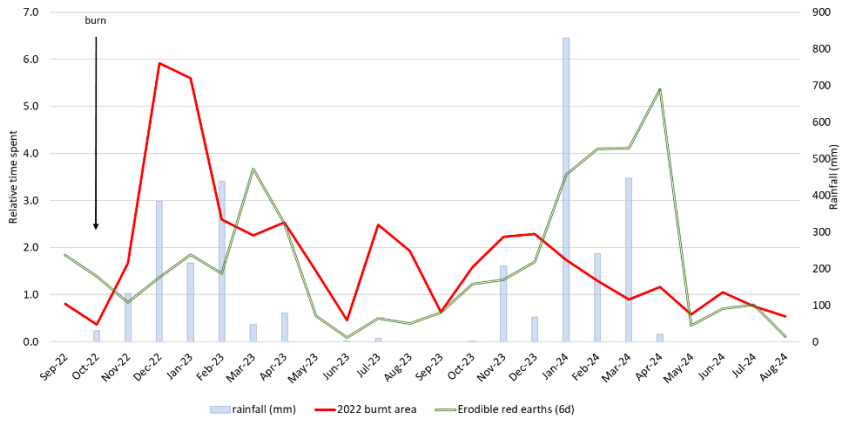

Figure 3. Relative time spent (averaged monthly) following fire on erodible red earths (6d) compared to burnt area in Conkerberry paddock.

Discussion

Cattle are known to prefer red soil areas during the wet season to avoid boggy conditions on the black and grey clays (Hunt et al. 2007), so it is unclear if the preference for red soil areas in the second wet season after fire in Conkerberry paddock was what occurs naturally, or if there was still some lagging effect of the previous years burn on cattle preference. Further monitoring of landscape preference in both paddocks over time will help to distinguish background versus burn driven landscape preferences.

The significant increase in cattle presence within the burnt areas during the wet season suggests that fire-stimulated regrowth attracts cattle, aligning with previous studies highlighting the nutritional appeal of post-fire vegetation (Reid 2022). Similarly, Fuhlendorf and Engle (2004) found that integrating fire and grazing can create a dynamic forage mosaic that redirects grazing activity and balances land use across heterogeneous landscapes.

Burning also reduced grazing pressure on more productive grey clays, particularly in the year there was fire introduced to the paddock. This outcome supports the hypothesis that pyric herbivory can mitigate overgrazing in high-value areas, increasing the potential for recovery. Moreover, the reduced time spent on erodible red earths (6d) during the burn year highlights the potential of fire to divert grazing pressure from ecologically vulnerable areas. Grazing in these areas during non-burn years likely exacerbates soil erosion and pasture degradation, a concern corroborated by Mott (1986), who linked uneven grazing patterns to environmental decline.

The strong preference for burnt country by cattle highlights the potential for overgrazing. It is important that the patch burn area is large enough to not be too heavily grazed but small enough to ensure some parts of the paddock are rested. Stocking rates should also be adjusted to match the carrying capacity of the paddock.

It is difficult to assess changes in land condition over short periods of time however photo monitoring points and regular pasture monitoring will continue to measure the effects of patch burning within the burn area and surrounding land types.

The findings of this study suggest pyric herbivory can be effective in redistributing grazing pressure and enhancing the utilisation of underused areas in tropical rangelands.

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