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Animal Impact Promotes the Regeneration of Grasslands: The Advantage of Being Eaten

Introduction

European settlement and the implementation of management practices that are not aligned with the Australian environment have led to the degradation of around two-thirds of Australia's agricultural land[1]. This degradation can be reversed by implementing regenerative management to restore ecosystem function. At Packhorse, we do not own cattle, but we recognise animals' crucial role in grassland regeneration. **Grazing removes old and decaying plant material, stimulating new plant growth, while animal excreta fertilises the land promoting faster nutrient cycling.** Optimal grazing management therefore accelerates land regeneration by invigorating plant growth.

How do animals promote the regeneration of grasslands?

Grazing removes old grass and accelerates new grass growth

Grazing of grasslands removes older, less photosynthetically active grass. The removal of old and dead tissues stimulates the growth of the remaining plant by increasing photosynthetic activity, increasing the production of new leaves and reproductive tillers, and improving water use efficiency through the reduction of the transpirational leaf area [1]–[3]. The removal of dense litter and standing dry matter also increases the emergence of a variety of seedlings through greater light penetration at the base of the sward [4], and promotes plant diversity by preventing the dominance of one plant species [5].

Animal excreta promotes fertilisation and nutrient cycling

The presence of cows promotes the return of nutrients to the soil, which supports further plant growth. Without cows, nutrients are slowly returned to the soil via the decomposition of dead or decaying leaves. With cows, nutrients are returned to the soil via litter decomposition and animal excreta (dung and urine). Excreta is much more easily decomposed and quickly replenishes the soil with nutrients [4], [6], particularly when dung beetles are present [7]. Grazing thus promotes higher nutrient availability by maintaining a pool of readily mineralisable organic nutrients near the soil surface where it is more accessible to the microbial community – the so-called engine of the food chain [8].

Grazing promotes biodiversity

Grazing can increase the species richness and promote a more favourable pasture structure than ungrazed systems. Without grazing, tussocks can develop into dense swards smothering plants in the gaps, allowing one species to dominate at the expense of an array of species that can occupy the inter-tussock spaces [9], [10]. A diverse pasture and tussock structure also provide shelter, nesting substrate, predator avoidance, and other functions for a range of animals [11].

Grazing promotes increased soil carbon

Active grazing of pastures can significantly increase soil carbon stocks [4] the cornerstone of soil health. Increasing the organic carbon content of soil benefits agricultural production, and ecosystem services enhance soil aeration, permeability, available moisture, and nutrient cycling and stores carbon that would otherwise be warming the atmosphere [12]–[14]. For example, in a controlled experiment where cattle were removed from a native pasture in Australia, this significantly decreased soil organic carbon content in comparison to an adjacent site that remained grazed (time-controlled grazing carbon content = 33 tC/ha versus ungrazed = 26 tC/ha) [4].

A greater accumulation of soil carbon in grazed systems is primarily due to the greater return of plant biomass to the soil though several different pathways. Firstly, animals promote the growth of plants

[1] *https://www.australiancollaboration.com.au/pdf/FactSheets/Land-degradation-FactSheet.pdf*

and the transfer of dead and decaying plant material into soil organic matter by trampling residues into the soil [15]. Trampling also producers a mulching layer that conserves soil moisture and prevents soil erosion. Secondly, grass removal through grazing reduces the amount of biomass lost to the atmosphere as CO_2 through photodegradation [16]. Photodegradation operates in water limited ecosystems with a high incidence of UV-B radiation. It represents a short circuit in the carbon cycle, whereby carbon is returned directly to the atmosphere without cycling through the soil organic matter pool. Finally, animal excreta feeds soil microbes, increasing carbon turnover and generating microbial necromass, which has been demonstrated to form the majority of stable soil organic carbon [17]. As Dr Frank Mitloehner[2] stated, the **"inclusion of animals in the landscape puts soil carbon sequestration on steroids".**

The type of animal impact is important: not all grazing leads to favourable outcomes

There is a huge opportunity to restore degraded grasslands by using animals to recycle and reinvigorate grasslands and restore ecosystem function. However, it must be the right kind of animal impact.

Heavy continuous grazing allows sustained access to plants by animals without an opportunity to recover between grazing events. This approach has been documented as contributing to severe adverse effects, such as depletion of root biomass and carbohydrate reserves in selectively grazed plants, reduction in above ground productivity, more bare ground, lower soil carbon stocks, and increased soil erosion and compaction [18], [19].

In contrast, regenerative management uses a goal-oriented, proactive, multi paddock grazing strategy focused on restoring degraded grasslands' ecological function and productivity [20]. During each short, intense grazing episode, all plant species are exposed to grazing for a limited duration so that only around two-thirds of the biomass is consumed. Then, during the recovery period, because of the more evenly distributed nature of excreta and the trampling of the remaining vegetation, the plant species have an equal chance to capture the available nutrients, water, and sunlight resources for regrowth bounce back post recovery [6]. This results in greater plant productivity than continuously grazed paddocks, as plants have a younger average leafage and spend a greater proportion of time in the linear phase (phase 2) of the growth curve (Figure 1) [6].

Caring for our cattle

While animals are on our properties, we are committed to giving them the best life, ensuring freedom to express normal behaviour and feeding on natural grasslands. Our starting point for good animal welfare is that our cows are sentient beings with a right to proper and humane treatment. **Happy, healthy and well-cared for cattle are integral to our sustainability.** We have drawn upon the Five Freedoms of animal welfare, an internationally recognised standard to promote optimal animal health and welfare. Animals have freedom from pain, injury and disease, fear and distress, discomfort, hunger and thirst, and the freedom to express normal behaviour. The implementation of this framework is provided in more detail in our Animal Health and Welfare Policy.

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[2] *Presentation by Dr. Frank Mitloehner (researcher based at UC Davis, USA) on Animal Impact and Carbon Storage, 2022.*

Conclusion

In conclusion, if we are to meet our future food security needs, we cannot take existing agricultural land out of production (for example re-wilding). Instead, we must promote regenerative agricultural systems that deliver productivity and environmental gains hand in hand.

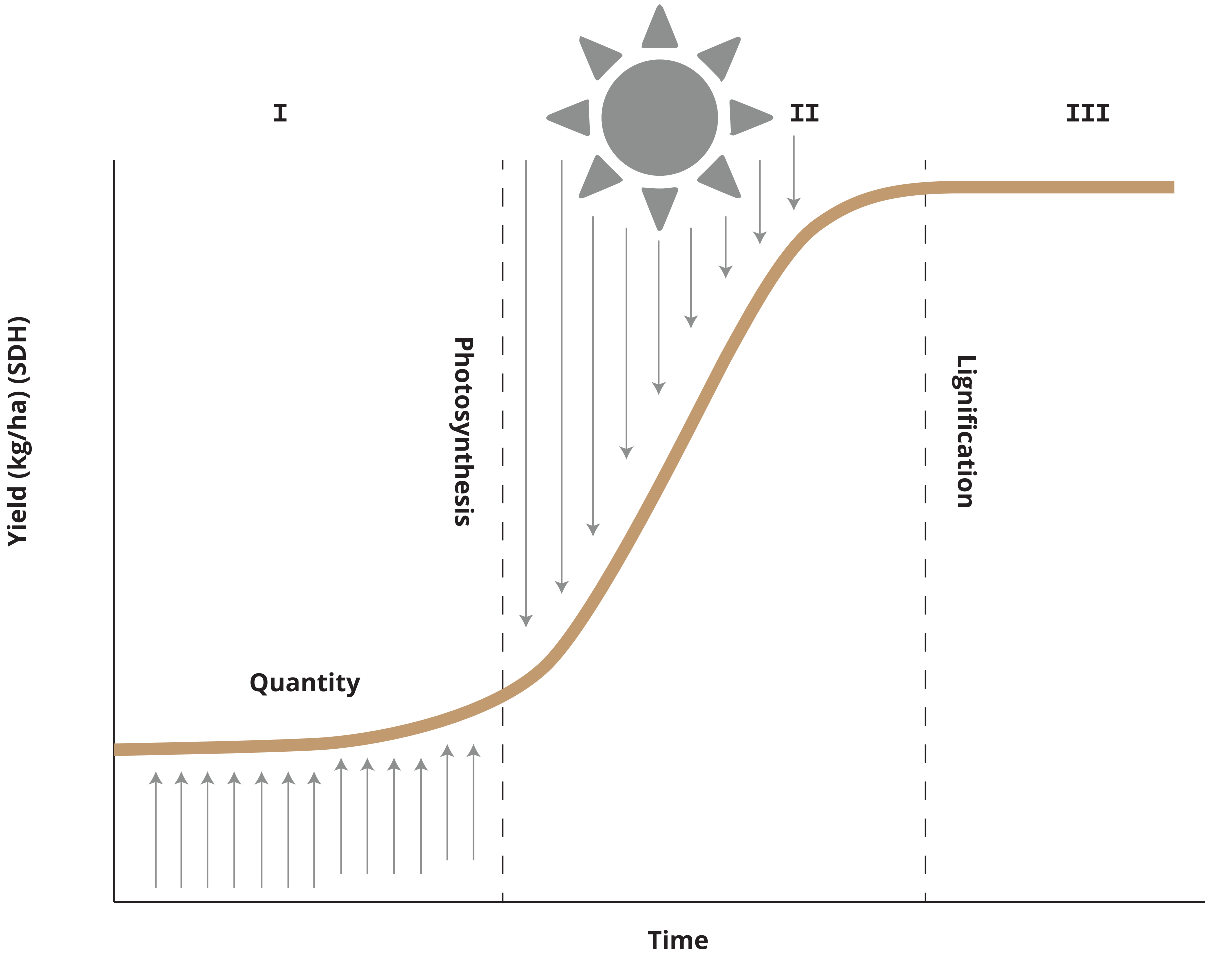

Figure 1: *Phase 1 is characterised by shorting growing grass and a corresponding short root system. Plant in phase 1 have a small green leaf area and therefore photosynthesis is restricted and energy for growth is supplied by the roots. Phase 2 is characterised by an abundance of green lead area and an actively growing plant. This is the prime time for grazing the plant and short graze periods will significantly extend this phase. Phase 3 is where the plant elongates and leaf area is replaced by lignification. Plant cells walls become increasingly thicker and photosynthesis is significantly reduces as plants stop growing and energy for growth is no longer needed (Source, RCS [21]).*

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PO Box 255, Paddington QLD 4064
t. 07 3858 0502 | **packhorse.net.au**