Policy development to drive regenerative rangeland management

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Abstract

Semi-arid rangeland livestock businesses suffer a burden of market failure that leads managers to perceive regenerating degraded rangelands to be commercially unattractive. Management practices that risk continued land degradation, particularly in extended dry seasons, can therefore be the norm. In the context of pastoral businesses, market failure is a product of slow rates of rangeland recovery and the time value of money (Wang and Hacker 1997), resulting in incremental, long-term degradation of the natural resource, that is barely perceptible in the short term. This paper provides policy rationale and scientific evidence to support cost-neutral government and industry policies, to provide timely financial incentives that overcome the time value of money barrier, enabling land managers to adopt practices that improve ground cover, a precursor of soil and vegetative carbon sequestration, as well as increased biodiversity and livestock production.

Keywords: rangelands, degradation, ground cover, soil carbon, biodiversity.

Introduction

The commercial reality of pastoralism operating within the confines of government policies, particularly in relation to control of total grazing pressure (TGP) (Hacker et al 2020), has created long term incremental losses in range condition documented in numerous royal commissions e.g. Fyfe 1940, scientific reports (McKeon et al 2012) and the State of the Environment Report (2021). Wang and Hacker (1997) conducted rigorous analyses of pastoral decision-making based on optimal control theory and in-depth knowledge of rangeland pasture recovery rates, to explain why it has not been commercially attractive to regenerate degraded rangelands. The default option of ‘business as usual’ management risks the continuing degradation of rangelands. This commercial reality results from landholders’ preferences for the time value of money and relatively slow recovery rates of degraded rangelands. Hacker et al (2010) argued that this scenario justifies government interventions such as financial incentives for ground cover outcomes, that overcome the time value of money barrier, to ensure that pastoral management conforms with Australian community expectations for maintaining healthy natural resources. However, the global warming emergency has created markets for soil carbon and biodiversity that could provide opportunities to reverse this destructive cycle and drive adoption of regenerative management practices to begin rebuilding lost natural capital in the form of soil organic carbon (SOC) and biodiversity, as well as more resilient pastoral production systems.

A Ground Cover Credit scheme to drive regenerative management

The basic thesis of this paper is that financial incentives for improvement of ground cover could be integrated into the developing markets for sequestered carbon and enhanced biodiversity in a way that both complements these markets and provides an incentive to regenerative pastoral management.

The design of a Ground Cover Credit (GCC) as a Stage 1 Australian Carbon Credit Unit (ACCU), under the Australian Carbon Credit Scheme, complemented with a simplified Stage 1 Biodiversity Credit under the pending Nature Repair Market bill, could be accommodated under existing and proposed Commonwealth legislative and administrative structures. A GCC scheme could require participants to commit to converting from Phase 1 status to a full carbon farming project under the pending Integrated Farm and Land Management (IFLM) method, when costs of measuring SOC are acceptable, and converting to full biodiversity certification under the pending Nature Repair Bill. The GCC scheme could be designed to enable documentation of changed management practices, made possible only through the GCC scheme's financial incentives, to allow seamless transition into the IFLM method, having already met the additionality requirements.

Large emitters of green-house gases covered by the Australian Safeguard Mechanism will need carbon credits to offset emissions above their regulated baselines. They could see merit in investing in GCCs to secure future supplies of high quality ACCUs to meet increasing obligations to the Safeguard Mechanism, making the scheme cost-neutral for government.

Bastin et al (2012) developed remote sensing technologies to separate management and seasonally related ground cover outcomes. More recent developments in remote sensing suggests that management-related ground cover outcomes could be reliably detected 12 months after management changes (Beutel et al 2021, Donohue et al 2021, Turner et al 2023).

The Blueprint (CMI 2021) relating to the IFLM method development, and recent DCCEEW updates indicate that carbon credits can be claimed for increases in SOC and vegetative carbon in biomass higher than 1.3m, without the 20% canopy cover restrictions of the superseded HIR method. These changes, to be finalised for 2024 release, will enable significant expansion in areas eligible for carbon farming projects. However, economic viability depends on the success of current R&D to develop low-cost measurement and modelling of both carbon pools. Global developments in proximal sensing (Wijewardane et al 2020), remote sensing (Angelopoulou et al 2019) and flux tower technologies (TERN 2021), suggest that costs of accurate SOC measurements will decline significantly. However, it could be several years before current R&D enables viable carbon farming projects to operate across these expected expanded areas of the semi-arid Australian rangelands.

The biological basis for a Ground Cover Credit scheme

Productivity benefits of improving ground cover

D'Abaddie (2021) modelled different cattle production systems showing the economic and drought resilience superiority of producing 330-365kg steers with low stocking rates, that build forage buffers for maintaining herd productivity through two successive decile-2 drought years. Forage buffers provide abundant ground cover that drives perennial plant regeneration, accumulation of SOC and improved biodiversity. Management that maintains forage buffers for provisioning pasture in drought years requires forage of adequate nutritional value. This production system has operated for over a decade at Old Man Plains research station, NT, demonstrating that the quality of dry forage buffers in regenerated mulga ecosystems delivers average weight gains of 0.5kg per day from weaning at six months through to sale as trade steers at 30 months. Steers required only one period of green forage in the 24 months period to lay down sufficient fat to enable the majority to meet Meat Standards Australia grading requirements at slaughter (Materne et al 2017). Maintaining this forage buffer implies that management provides the ‘constant care’, that leading soil scientists state is required to optimise accumulation and persistence of SOC (Lehmann et al 2020). New paradigms of soil science suggest that SOC accumulation and persistence is more a function of soil ecosystems than of soil texture (Begill et al 2023, Lehmann et al 2020, Schmidt et al 2011) auguring well for the extensive low-clay soils of the southern rangelands.

A GCC scheme could also apply to the northern rangelands and drive rapid adoption of regenerative management practices across all the 338Mha (Productivity Commission 2002) of grazed Australian rangelands by providing financial incentives, delivered within 18-24 months of project commencement, to remove the time value of money barrier identified by Wang and Hacker (1997). Increasing biomass production and plant root dynamics to drive SOC accumulation and persistence (Lehmann et al 2020, Sanderman et al 2010) will require advanced grazing and land management practices, particularly rigorous control of TGP in low rainfall periods (Hacker and MacDonald 2021). Significant investments in station infrastructure for improved animal control may be required and modifications to landform may also be necessary to address water loss due to malfunctioning drainage systems (Pringle and Tinley 2003). These investments, that may also include significant changes in herd structures, are not likely to be commercially attractive (Wang and Hacker 1997), without timely financial incentives that a GCC scheme could provide.

Regenerating rangelands’ soil health and soil carbon stocks

The process of regenerating degraded rangelands in Mediterranean environments has been described by Le Houerou (2006) as a series of 16 cascading actions and reactions that are triggered initially by the production of organic matter, that is later incorporated into the soil. Le Houerou describes the eventual outcome as an increase in populations of perennial plants, improvements in water use efficiency, ecosystem functioning and productivity. These developments will also increase carbon stocks (Lal et al 2018). It is likely that both southern and northern Australian rangelands will mimic the regeneration processes described above for Mediterranean rangelands.

A study of SOC changes in 20 to 40 year-old exclosures (Carter et al 2006, Daryanto et al 2013, Witt et al 2011) and perennial cover data reported by Orgill et al (2017) and Waters et al (2015) in the grazed areas of the semi-arid rangelands, suggests that with regenerative management, average SOC sequestration rates of 0.1 ACCU per ha per annum, could be reliably achieved, without any addition from vegetative ACCUs accessible under the new IFLM method. Research shows that light or moderate grazing pressure sequesters more SOC than no grazing (Piñeiro et al 2010, Wang et al 2017), suggesting that exclosure data may understate the quantum of SOC sequestered. In northern Australia, Bray et al (2016) analysed SOC data from 329 sites, reporting that the land condition indicators most closely correlated with SOC stocks included ground cover, pasture biomass and density of perennial grasses. Badgery et al (2020) reported total organic carbon changes, 16 years after the establishment of improved perennial pastures in central NSW. These pastures gained 1.6% in total organic carbon from the baseline despite mean rainfall during the last 4-year period falling to 14% below the mean of the previous 12 years and 20% below the long-term mean.

Globally, Piñeiro et al (2010) reviewed grazing effects on soil organic matter for 67 paired comparisons of grazed vs. ungrazed sites. Their main conclusion was that increasing N retention should be the primary means of increasing rangeland productivity and SOC sequestration. This conclusion is supported by Soussana and Lemaire's (2014) recommendation for temperate pastures, that avoiding harvesting more than 20% of biomass maintains the coupling of soil C and soil N cycles, balancing production with environmental outcomes. These findings support the potential for increasing SOC stocks by controlling TGP to build ground cover and regenerate perennial grasses, particularly across the 150Mha of the Australian mulga ecosystems, that often have relatively high levels of soil N (Pate et al 1998, Barnes et al 1992).

Evidence that ground cover is a precursor for improved biodiversity

Seinfeld et al (2006) argue that the livestock sector may play a major role in the reduction of biodiversity because of land degradation. Informed livestock management, however, can be a vehicle to maintain rangelands (O'Reagain et al 2018) or regenerate degraded rangelands with rigorous control of TGP to rebuild and maintain ground cover (Le Houerou 2006, Materne et al 2017).

The accumulation of organic matter on degraded rangelands increases populations of soil microbes and invertebrates that live in and feed on soil organic matter and surface litter (Le Houerou 2006). Multiple species of vertebrates will also repopulate in response to increased vegetative biomass. When maintained over time, improved ground cover will support regeneration of depleted perennial grasses and forbs. These diverse populations of plants, and their seeds, will provide habitats and food sources for birdlife and other vertebrates in the food web of a healthy ecosystem. The close linkages expected between increases in ground cover and improved biodiversity support the creation of Stage 1 Biodiversity Certificates that incorporate simple but sound biodiversity measures. Such a certificate would complement the GCC scheme and be able to convert to full Biodiversity Certification when legislation and measuring, monitoring and verifying systems are developed.

Conclusion

The high risk of rangeland degradation, when commercial forces are not compatible with the slow variables of rangeland ecosystem dynamics, may largely explain long term rangeland degradation across Australia. The burgeoning market for carbon and biodiversity products may provide a cost-neutral opportunity for government and industry to collaborate in developing policies and creating markets that will provide the Australian community with sustainable, biodiverse and profitable rangelands.

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