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Arresting grazing land condition decline in Queensland's northern gulf should be framed around improving business performance

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Abstract

Monitoring Australia's Northern Gulf region over the past two decades has shown a continuous decline in land condition, reflecting declining capacity to respond to rainfall and produce useful livestock forage. In 2004, 69% of monitored sites had their carrying capacity estimate reduced based on one or more land condition indicators, increasing to 92% in 2023. If grazing pressure and management on the ever-diminishing natural resource base continues as is, the rate of decline in land condition may further escalate.

On-property experience and research results demonstrate the importance of improved land condition, and consequently improved long-term land and animal productivity, profitability, and resilience to climatic variability. Northern beef industry financial performance data confirm business performance is maximised when per animal performance is maximised. But barriers to adoption persist and these must be overcome. Therefore, landholder engagement and extension efforts to improve land condition should focus on improving business performance through maximising per head animal performance while addressing constraints to adoption.

Introduction

The Northern Gulf area of Queensland, Australia covers 19.7 million hectares of native pasture. Rainfall is seasonal and highly variable (500-1200 mm between December to March; CV = 34 to 45%), and extreme weather events (heat waves, floods, seasonal droughts) and fire common (Rolfe et al. 2016). Rainfall variability and strong seasonality (long dry season) are the main drivers of pasture production.

Forage quality is highest during the wet season but declines during the dry season. Low protein concentrations and high stem fractions at the end of summer are normal, so low nutritional quality predominates for most of the year. Pasture growth accounts for 77% of carrying capacity variation across Queensland's soil types, land systems, pasture communities, grazing enterprises and climatic zones (Hall et al. 1998). Such poor pasture quality leads to low average annual cattle liveweight gains (~ of 100 kg head^{-1} year^{-1}), weaning rates (~56%), and high female mortalities of between 3 to 9% (Rolfe et al. 2016), and delivers low-income returns to grazing businesses. Many graziers have been caught in a downward spiral of carrying more animals (at ever declining productivity) to maintain the same output (Holmes, 2015; Rolfe et al. 2016). Chasing greater beef production per hectare, rather than per animal unit results in significant financial and environmental cost (O'Reagain, 2011; Walsh and Cowley, 2016).

Land condition decline is relevant across the rangelands in northern Australia, as well as around the world. Shaw et al. (2007) described a significant land condition loss in the Northern Gulf region, and subsequent monitoring in 2012 and 2016 recorded further declines (Shaw pers. comm.). Further monitoring in 2023 determined land condition had worsened.

Cost of Production ($ kg^{-1} LWt^{-1}) has the largest impact on northern Australian beef business profitability (McLean et al. 2023). Operating scale and labour efficiency are important in diluting these costs. However, kg beef AE^{-1}, a function of good reproductive efficiency, low mortality rates and higher turnoff weights, is best for measuring northern Australian beef enterprise productivity. These drive income but are impossible without good animal nutrition. Good nutrition can be either purchased or provided more cheaply by productive pastures under good land management providing better quality feed for much of the year. Less than ideal land condition can be considered potentially profitable but is inherently risky (MacLeod et al. 2004), with the link between good land condition and profitability not always obvious.

Our hypothesis is that Northern Gulf graziers should focus on kg beef produced Animal $Equivalent^{-1}$ (AE = 450 kg steer) output, associated with efforts to improve land condition. However, graziers firstly need to become aware that land condition is declining, and of the profitability-driving key performance indicators (KPI's) to facilitate change. This paper seeks to encourage extension efforts to be framed around the principles of good land condition providing nutrition and seasonal resilience, greater kg beef produced AE^{-1}, as a basis for sustainable profitability.

Methodology

The study comprised two research activities:

Land condition assessment in the Northern Gulf of Queensland

The ABCD framework describes grazing land condition (Chilcott et al. 2003). Pasture composition, soil condition, weed infestation and woodland density are assessed to assign a condition ranking to a land type. 'A' condition describes a land type at 100% of original carrying capacity; 'B' condition 75%; 'C' condition 45% and 'D' condition only 20% of original carrying capacity. Approximately 260 sites around the Northern Gulf region were assessed in 2004, 2012 and 2016 using Shaw's modified rapid land condition assessment methodology (Shaw et al. 2007). Their method relied on the observer having experience in the region to understand the original condition of a particular land type. 112 of the sites were revisited in each of the three years. In 2023, 289 sites were assessed for land condition around the same region using a land condition assessment tool (LCAT) App (Hassett et al. 2021). This tool enables rapid and consistent collection of standardised land condition data, and generates a land condition score immediately, based on the input data. However, LCAT scores are calculated differently to Shaw et al. (2007). Therefore, the 2023 LCAT data for above-mentioned 112 sites were reassessed in a desktop process using the rapid land condition assessment method. Three experienced land condition assessors, who had each been involved in all, or some, of the previous three surveys undertook the reassessment as a group with vigorous discussion. Site photos (usually 4 or 5) and species composition data collected through the LCAT App were used for the reassessment. Consequently, a standardised land condition dataset for the Northern Gulf region that includes site data from 2004, 2012, 2016 and 2023 was created (Gobius and Buchanan, 2024).

Remote sensing (VegMachine (https://vegmachine.net/)) was used to estimate canopy cover change as measured by Persistent Green, that portion of vegetation estimated to not completely senesce within a year, primarily consisting of woody vegetation (trees and shrubs), although occur exceptions occur when herbaceous cover remains green (Beutel et al. 2019).

Collating published evidence of a positive relationship between good land condition, good nutrition, greater kg beef/AE and profitability

Ten studies specifically linking land condition, livestock productivity and profitability were examined (Purvis, 1986; Landsberg et al. 1998; Paton et al. 1999; Smith, 2000; MacLeod et al. 2004; MacLeod et al. 2010; Broad et al., 2011; Walsh and Cowley, 2016; Bowen et al., 2019; and Hall et al. 2020).

Results

Land condition decline in the Northern Gulf

Carrying capacity in the Northern Gulf is estimated to have declined from 74% to 60% of the original since 2004, a 0.75% loss per annum, with pasture composition and timber thickening most responsible for land condition discounts (61% and 54% of sites, respectively). In 2004, 69% of rapid assessments were discounted due to one or more land condition indicators. This increased to 76% of sites discounted in 2012, 91% in 2016, and 92% in 2023. Persistent green woody vegetation levels increased from 13% in 2003 to 22% in 2022.

Collating published evidence of a positive relationship between good land condition, good nutrition, greater kg beef produced/AE and profitability

The key management decisions identified through the literature review leading to improved land condition were:
Good record keeping to objectively measure change in management and productivity over time; reduced stock pressure, safe stocking rates, constrained variable strategies or better matching of stocking rate to carrying capacity; enabling rest and wet season spelling; using fire to manage trees, pasture quality and grazing pattern; timber thickening management; rehabilitation of degraded land and pasture improvement; cross breeding for better productivity; pregnancy testing and culling non-performers; a supplementation program.

The key benefits of improved land condition identified through the literature review were:
Improved land condition and resilience in a variable climate; improved live weight gain and turnoff weights; improved body condition scores and weaning rates; reduced mortalities; reduced steer turnoff age, earlier mating, higher turnoff percentages; no need to reduce stocking rates; less feed shortages, stable animal/herd production and sizes, lower frequency and scale of feeding costs; lower input costs and improved profitability and business resilience in variable years; more sleep and fewer worries; reductions in livestock greenhouse gas emission intensity.

Discussion

The literature evidence, in conjunction with the Australian Beef Report evidence (McLean et al. 2023) that income from profitable enterprises is derived from kg beef produced/AE, suggest that improving land condition in the northern Australian rangelands will increase profitability. The Australian Beef Report identifies that Cost of Production (COP), kg beef produced/AE and operating scale are the main KPI's for northern beef enterprises. When kg beef produced/AE is optimised, COP/AE is diluted, particularly when scale and labour efficiency are maximised. This discredits the common practise of targeting kg beef/ha by increasing stocking rates to combat declining land condition and productivity.

Species composition interacts with seasonal conditions to define animal production potential. Although relationships between liveweight gain per hectare and per animal are well understood (Jones and Sandiland,1974), they are often ignored or misunderstood by graziers. Perennial species contribute most to rangeland animal production on a long-term basis, and when seasonal conditions are near or below the mean. But in certain above average rainfall years (particularly when both rainfall amount and wet season duration are above average), short annual and biennial plant species can significantly augment animal production (Hacker and Tunbridge, 1991) and so create significant inter-annual liveweight variation. This inconsistency in the impact of perennial species can act as a barrier for graziers in clearly understanding the land condition/stocking rate/liveweight gain relationships, as graziers tend to 'anchor' on these 'good' years, making extension messages difficult. While recognizing this potential variation between years, extension effort must focus on making graziers more aware of the overarching and positive relationship between good land condition, appropriate stocking rate, good nutrition, greater kg beef produced/AE and profitability.

Group extension work with graziers serious about achieving financial and environmental sustainability should firstly be about awareness of the degree of land condition loss regionally and on their own properties; understanding the business profit drivers and having a sustained focus on them; and acquiring financial literacy. Consequently, one-on-one extension should: enable managing landscapes using evidence-based knowledge and

skills; use Breedcow Herd Budgeting software to model the impact of declining land condition and identify herd management practises that can improve productivity while reducing stocking rates (Bowen et al., 2019); enable management decisions based on both financial and environmental outcomes (Walsh and Holmes, 2023). If grazing pressure and management on the ever-diminishing natural resource base continues as is, the rate of decline in land condition may further escalate. Once land condition declines to ~ 20% of original condition, it is almost impossible to reverse without costly mechanical intervention (MLA, 2024). We are under no illusions of how long land condition recovery might take; it is likely to be slower than the recorded 0.75% per annum loss of retained original carrying capacity. If land condition could be improved at 0.5% of carrying capacity per year, improving from 60% back to 75% retained original carrying capacity (B condition) will be the responsibility of the next generation of land managers. This next generation should be targeted by beef extension officers.

Conclusion

Land condition decline is relevant both across Australia's rangelands and internationally. In the absence of legislative oversight of rangeland condition, solutions are required to arrest this decline. Barriers exist to the adoption of extension messages. Extension must focus on grazier understanding of the decline in land condition, and the link between greater land condition and potential long-term profitability, highlighting management practices that will maintain or improve profitability through improved reproductive efficiency and turnoff weights, and reduced mortality and costs of production, while reducing stocking rates. Decades of warning producers of excessive stocking rates have been ignored. Stocking rates are more important than management systems in determining vegetation change (Hacker and Tunbridge, 1991) and should be closely matched to sustainable use the available pasture supply, providing homegrown feed base quality and quantity. In collaboration with industry, we need to facilitate necessary land management change before further damage to landscapes and livelihoods becomes irreversible.

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References

Bowen, MK, Chudleigh, F, Rolfe, JW and English, BH (2019) Northern Gulf production systems: Preparing for, responding to, and recovering from drought. (The State of Queensland, Department of Agriculture and Fisheries, Queensland: Brisbane) Available at https://futurebeef.com.au/projects/improving-profitability-andresilience-of-beef-and-sheep-businesses-in-queensland-preparing-for-responding-to-andrecovering-from-drought/ [Accessed 6 June 2020]

Beutel T, Trevithick, R, Scarth, P and Tindall D (2019) VegMachine.net. online land cover analysis for the Australian rangelands. The Rangeland Journal, 41, 355–362 https://doi.org/10.1071/RJ19013

Broad K, Bray S, English B, Matthews R and Rolfe J (2011) Adapting to beef business pressures in the Gulf. In Proceedings of the Northern Beef Research Update Conference p. 176.

Chilcott, CR, McCallum, BS, Quirk, MF, and Paton, C. (2003) Grazing land management education package; workshop notes – Burdekin. Meat and Livestock Australia Limited, Sydney.

Gobius N and Buchanan, K (2024) Northern Gulf 2023 Land Condition Trend Report – Rapid Assessments. Report prepared for Gulf Savannah NRM. 17/06/2024

Hacker RB and Tunbridge SB (1991) Grazing management strategies for reseeded rangelands in the east Kimberley region of Western Australia. *The Rangeland Journal 13(1)*, 14-35

Hall WB, McKeon GM, Carter JO, Day KA, Howden SM, Scanlan JC, Johnston PW and Burrows WH (1998) Climate change in Queensland's grazing lands: 11. An assessment of the impact on animal production from native pastures *Rangeland Journal*. 20(2) 177-205

Hall TJ, Silcock RG and Mayer DG (2020) Grazing pressure and tree competition affect cattle performance and native pastures in Eucalypt woodlands of Queensland, north-eastern Australia. *Animal Production Science* 60, 953–966

Hassett, R., Beutel, T., Brooks, E., Graz, P., Humphreys, P., Northey, A. and McCosker, K., 2021. Land condition assessment tool (LCAT)—documenting land resources and condition., 1–5, Available at: https://austrangesoc.com.au/wp-content/uploads/2022/10/15.-Land-condition-assessment-tool.pdf. [Accessed 26 November 2024]

Holmes, PR (2015) Rangeland pastoralism in northern Australia: change and sustainability. *The Rangeland Journal* 37, 609-616

Jones, RJ and Sandilands, RL (1974) The relation between animal gain and stocking rate: derivation of the relation from the results of grazing trials. *J. Agric. Science,* 83 (2), 335-342.

Landsberg RG, Ash AJ, Shepherd RK and McKeon GM (1998) Learning from history to survive in the future: management evolution on Trafalgar Station, north-east Queensland. *Rangeland Journal*. 20(1), 104-18

MacLeod ND, Ash AJ, McIvor JG (2004) An economic assessment of the impact of grazing land condition on livestock performance in tropical woodlands. *Rangeland Journal* 26, (1), 49-71 ref. 43

MacLeod N, Scanlan J, Whish G and Pahl L (2010) Bio-economic modelling of beef grazing enterprises to inform sustainable grazing management of northern Australian grazing lands. Book chapter (Conference paper): "Food Security from Sustainable Agriculture", Proceedings of the 15th Australian Agronomy Conference, 15 - 18 November 2010, Lincoln, New Zealand, 2010, 7199 ref. 8 Conference title: Food security from sustainable agriculture. 15th Australian Agronomy Conference, Lincoln, New Zealand, 15-18 November 2010.

McLean IA, Wellington MJ, Holmes PR, Bertram JD and McGowan, MR (2023) The Australian Beef report 2023, Bush Agribusiness Pty Ltd: Toowoomba Qld.

MLA (2021) Cattle numbers – as at June 2021 Natural Resource Management Region. https://www.mla.com.au/globalassets/mla-corporate/prices--markets/documents/trends--analysis/fast-facts--maps/mla_cattle-distribution-map-june-2021_v02-final.pdf [accessed 25/11/2024]

MLA (2024) Understanding land condition. Meat & Livestock Australia April 15, 2024. https://elearning.mla.com.au/lessons/understanding-land-condition/ [accessed 2/12/2024]

O'Reagain P and Bushell J (2011) Long term effects of different grazing strategies on productivity, profitability and land condition in a variable climate. *Proceedings of the Australian Rangelands Society Biennial Conference*.

Paton C, Hansen V-L, Tyler R, Greenup A, Darrow B, Day J, Crosthwaite I & Edwards W (1999) People and rangelands: building the future. *Proceedings of the VI International Rangeland Congress*, Townsville, Queensland, Australia, 19-23 July, 1999. Volumes 1 and 2., 1999, 451-452

Purvis JR (1986) Nurture the land: My philosophies of pastoral management in central Australia. *Australian. Rangeland Journal* 8(2) 110 – 117

Rolfe JW, Larard AE, English BH, Hegarty ES, McGrath TB, Gobius NR, De Faveri J, Srhoj JR, Digby MJ and Musgrove RJ (2016) Rangeland profitability in the northern gulf region of Queensland: understanding beef business complexity and the subsequent impact on land resource management and environmental outcomes. *The Rangeland Journal* 38: 261-272.

Shaw KA, Rolfe JW, English BH and Kernot JC (2007) A contemporary assessment of land condition in the Northern Gulf Region of Queensland. *Tropical Grasslands* 41: 245-252.

Smith D (2000) Promis 1480 NHT 962011 Northern Stocking Rate Demonstration, Queensland Department of Primary Industries, Report to Natural Heritage Trust, Charters Towers, Queensland.

Walsh D and Cowley R (2016) Optimising beef business performance in northern Australia: what can 30 years of commercial innovation teach us? *The Rangeland Journal* 38, 291–305

Walsh D and Holmes PR (2023) Fortifying the financial and environmental capital banks in commercially grazed rangelands. *Rangeland Journal* 44, No. 5/6, RJ22030