

Beneficial land sector change in far northern Australia is required and possible – a refutation of McLean and Holmes (2019)

Jeremy Russell-Smith^{A,B} and Kamaljit K. Sangha^{ID}^A

^ADarwin Centre for Bushfire Research, Charles Darwin University, Darwin, NT 0909, Australia.

^BCorresponding author. Email: jeremy.russell-smith@cdu.edu.au

Abstract. In a recent paper we set out a case for extending current and emerging ecosystem services enterprise opportunities to support sustainable land sector development in far northern Australia (Russell-Smith and Sangha 2018: *The Rangeland Journal* 40, 315–330. doi:10.1071/RJ18005). In that paper we illustrate very significant economic viability and environmental sustainability issues associated with the current dominant land use, the extensive rangeland beef cattle industry. Our beef enterprise economic assessments drew heavily on reports by Ian McLean, Phil Holmes and colleagues, as well as various other authoritative studies. In a detailed response, McLean and Holmes outline their concerns that, in various instances, we misrepresented their data and that our assessment ‘does not accurately portray the economic performance and contribution of the pastoral sector in northern Australia, nor justify the conclusion that fundamental land sector change is required’ (Comment by McLean and Holmes 2019: *The Rangeland Journal*, 41, 157–160. doi:10.1071/RJ18098). We acknowledge the singular contributions of those authors for our understanding of the enterprise characteristics and challenges faced by northern beef producers, but further, we: (a) for context, demonstrate the magnitude of the economic and sustainability challenges faced by the majority of northern beef producers as described in a range of pertinent studies including their own; (b) provide a detailed refutation of all eight of their listed concerns; and (c) conclude that available evidence does in fact strongly support the need for exploring diversified enterprise opportunities towards developing a sustainable and inclusive far northern land sector.

Additional keywords: ecosystem services, land use, northern development, pastoral enterprise, rangelands.

Received 14 May 2019, accepted 23 July 2019, published online 16 September 2019

Introduction – sustainable land sector development challenges in Australia’s ‘far north’

Sustainable land sector development in northern Australia faces many recognised challenges and lesser appreciated opportunities. For the most part, the major current land use focuses on extensive beef cattle production in a region characterised by poor soils, significant climate variability, predicted significant extenuating climate change in decades ahead, frequent fires, and volatile market conditions. In two recent papers we have: (a) independently re-assessed key findings of comprehensive authoritative pastoral enterprise economic assessments (McLean *et al.* 2014; Bray *et al.* 2015; Holmes 2015; Holmes *et al.* 2017), which collectively describe challenging conditions facing the north Australian beef industry, including in our focal region (essentially 1.2 M km² of the far northern savanna region above the long-term 600 mm rainfall isohyet, less the humid wet tropics); (b) provided exploratory assessments of associated ‘hidden’ environmental costs associated with the pastoral industry; and on these bases set out a case that (c), for those parts of the ‘pastorally unproductive far north’, it is time to recognise and capitalise on the region’s internationally significant cultural and natural resource

‘ecosystem services’ values, including in conventional (e.g. eco-tourism) and novel (e.g. carbon, biodiversity offsets) markets (Russell-Smith and Sangha 2018; Russell-Smith *et al.* 2019). Our simple contention is that all ‘far north’ savanna stakeholders, including economically strapped pastoral enterprises, would benefit substantially from such diversification opportunities.

In critiquing the Russell-Smith and Sangha (2018) study, McLean and Holmes (2019) outline their concerns that, in various instances, we have misrepresented their data and that our assessment ‘does not accurately portray the economic performance and contribution of the pastoral sector in northern Australia, nor justify the conclusion that fundamental land sector change is required’. Although we refute these matters in detail in sections following, it is important to acknowledge the very significant contributions those authors (and colleagues) have made in developing an unparalleled evidence base for understanding the contemporary enterprise characteristics and common challenges faced by northern beef producers; parts of our assessments simply could not have been undertaken without generous access to their data.

To provide a broader context for this discussion, it is necessary to first illustrate the immense recognised challenges

faced and posed by the northern pastoral industry. With reference to Holmes' (2015) insight that long-term pastoral enterprise viability requires diligent attention both to business management and sustainable natural resource stewardship – and evident interdependencies between these – we summarise some identified key challenges in Table 1 for the northern pastoral industry generally, and with specific allusion to conditions in our 'focal area' where pertinent. Of course, any major industry also

requires social licence to operate and, in the case of the Australian beef industry, significant additional headwinds include ethical issues related to cattle live-export, tree clearing especially in Queensland, minimising greenhouse gas emissions, biodiversity conservation and catchment-scale sediment runoff issues, meat (and artificial meat) consumer trends. Running a successful rangelands pastoral enterprise in the 21st century evidently requires dedicated participation in a heavily contested paddock.

Table 1. Core generic challenges facing long-term economic viability and environmental sustainability in the northern pastoral industry

Long-term economic viability

- The majority of northern beef producers are not economically sustainable as they are not able to fund present and future liabilities (McLean *et al.* 2014; p. 10)
- At the individual beef business scale, productivity growth and returns on investment in the northern Australian beef industry are generally static or declining and, together with high debt levels and increasing input costs, many northern grazing businesses are in a dire financial situation (Bray *et al.* 2015; p. ii)
- The future of [northern] rangeland pastoralism as an industry is questionable, if only the minority (~20%) of businesses can satisfy the criterion of long-term financial sustainability (Holmes 2015; p. 615)
- The financial performance of the beef industry in Australia is alarming. The average performance of the majority of cohorts in the north and south are operating at a loss before interest and tax. Where there is a positive average performance, it is predominantly caused by the Top 25% performers effectively dragging the average up, as the bottom 75% are operating at a loss (Holmes *et al.* 2017; p. 52)
- ... few of the top performers in the north, and none in the south, are generating long-term returns which exceed their cost of capital (Holmes *et al.* 2017; p. 71)
- ... many pastoralists seem reluctant to embrace change that will improve business performance, but takes them outside their comfort zone (Holmes 2015; p. 614)
- Lack of financial literacy and business skill remain the biggest impediment to most pastoralists achieving financial sustainability in their businesses because while this impediment is in place, pastoralists lack the perception and ability to identify herd and whole business profit drivers for improvement (Holmes 2015; p. 615)
- Producers need to recognise the need for better business management practices and actively improve their skills to be successful in the modern business environment (Rolfe *et al.* 2016; p. 270)

Environmental sustainability

- Tropical tallgrass communities are sensitive to grazing and can tolerate only relatively low levels of utilisation (Ash *et al.* 1997; p. 136)
- There has been widespread decline in the density of the perennial tussock grasses associated with increased grazing pressure experienced [in recent decades] (Ash *et al.* 1997; p. 127)
- Unless there are significant changes in grazing management philosophy and practice in much of northern Australia. . . there will be accelerated loss of soils, biodiversity and socioeconomic value (Ash *et al.* 1997; p. 141)
- Northern Australia is over-grazed and there is evidence that environmental capital is being used-up (Dr Phil Holmes 2015; presentation at Beef Australia 2015, MLA Producer Forum 6 May, showing highlights from 2nd Northern Beef Situation Analysis report; <https://www.youtube.com/watch?v=zI5LE6T6shk>)
- The decline in rangeland condition is highly visible to extension and scientific agencies as well as the broader community. However, land degradation is largely 'unseen' by many producers operating within a market structure that offers no incentives for good land stewardship. . . Overgrazing, although rational for those maximising current earnings to ensure short-term survival, often occurs at the expense of maintaining the long-term productivity and capital value of the resource (Rolfe *et al.* 2016; p. 271)
- Rainfall variability is a major challenge to sustainable grazing management in northern Australia. . . occurs at annual, decadal and generational time-scales. . . [leading] to major temporal variability in forage supply. . . Since the 1960s the introduction of improved supplementation, hardier *Bos indicus* cattle, the provision of new water-points and the ability to truck cattle rapidly over long distances have significantly increased the capacity of graziers to manage for drought. . . these changes have also allowed high grazing pressures to be maintained both during and after droughts by some producers, increasing the risk of severe resource degradation (O'Regain *et al.* 2014; p. 223; see also McKeon *et al.* 2009)
- In addressing these issues O'Regain *et al.* (2014; p. 223) summarise best grazing management practice as including: Overall, stocking around the safe long-term carrying capacity will maintain land condition and maximise long-term profitability. . . Periodic wet-season spelling is also essential to maintain pasture condition and allow recovery of overgrazed areas
- However, as noted by Cowley *et al.* (2017; p. 5) this: raises the question of where to place stock during the wet season to enable annual WSS [wet season spelling]. If stock are placed on other areas during the wet season every year, how sustainable is this for the wet season grazed area over the longer term and how will it affect animal production over the wet season? Spelling less frequently would increase recovery times. Increasing stocking rates in some years to enable spelling in other paddocks would also either increase recovery times, or lead to further pasture decline
- The long-term significance of overgrazing on pasture health is starkly highlighted by Holmes *et al.* (2017; p. 85): It is sobering to consider that, depending on location, elevating land condition from D [degraded] to A [good health], even if possible, can take between 20–50 years
- In comparison to pastoralists in a good financial position, those in debt have less resilience to cope with drought; are less likely to adopt practice improvements needed for improving enterprise viability and environmental conditions; and are more likely to suffer adverse health effects (Crowley 2015; p. 2)
- Pastoralists in debt are likely to overstock their properties in an attempt to service their loans. . . the drive to repay loans may be an incentive for pastoralists to overstock in the short term despite the long-term degradation that will result (Crowley 2015; p. 92; see also ABARES 2014; McLean *et al.* 2014)
- Practices to improve viability and resource condition mostly go hand in hand, but many. . . enterprises are so stretched that they have neither the human, nor the financial capacity to make the changes required. . . pastoralists are most likely to overstock when they are under severe financial pressure. Therefore, finding pathways to guide struggling enterprises back into the black should be a high priority for any program promoting sustainable natural resource management (Crowley 2015; p. 147; see also Rolfe *et al.* 2016)

Finally, it is important to appreciate that our focal study region incorporates significant Indigenous demographic characteristics which are not addressed by any of the McLean and Holmes pastoral enterprise studies – (a) rapidly evolving Indigenous interests in land where, currently, Indigenous people have legal tenure to 28% of the region (Russell-Smith and Sangha 2018), and share title (Native Title) with a further 28% (Sangha *et al.* 2019); (b) outside of towns Indigenous people comprise a substantial proportion of the rural population, including about half in the Kimberley, Top End and Cape York, and more than 90% in very remote regions (Archer *et al.* 2019). Indigenous people own and run several very profitable cattle enterprises (e.g. Rural Industries Research and Development Corporation and McClelland Rural Services Pty Ltd 2012; Brann 2016) but, typically, Indigenous pastoral concerns occupy marginally productive lands and are unprofitable. Further, such marginality of much Indigenous pastoral estate presents significant economic and cultural management responsibilities given that ‘country’, once reacquired, is not real estate that can be traded (Archer *et al.* 2019) – unlike for non-Indigenous pastoral landowners who, as an economic last resort or for windfall gain, can avail themselves of phenomenally increasing land values, averaging around 6% annually over the past 20 years for a median-priced northern pastoral property (Rural Bank Ltd 2016). While developing sustainable diversified economic opportunities for the regional Indigenous demographic presents a singular challenge, we note that many similar issues pertain also to non-Indigenous pastoral enterprises in other regional community settings (e.g. Preece *et al.* 2016; Rolfe *et al.* 2016; Kerins and Green 2019).

Refuting McLean and Holmes’ concerns

In the abstract to their paper, McLean and Holmes note that our 2018 economic assessment ‘draws heavily on work by the present authors’. That is correct. Not mentioned is that we drew heavily also on a range of other economic, ecological and pastoral business datasets including ABARES (Australian Bureau of Agricultural and Resource Economics and Sciences 2014, 2017; and other reports), Bray *et al.* (2015), Meat and Livestock Australia (2017), Rolfe *et al.* (2016), Tothill and Gillies (1992), and consultations with pastoral experts. We respond below to the specific comments as listed in McLean and Holmes (2019).

Incongruity of geographical areas?

McLean and Holmes state ‘the authors quote data from the ‘entire northern region’ to summarise their economic assessment’. This is incorrect. We followed the pasture productivity regions identified by Bray *et al.* (2015) which are either exactly the same or larger than the regions defined by ABARES. For example, ABARES – Kimberley (Region 511), and the Top End (Region 714) and Victoria River District (Region 713) in the NT directly correspond to the Kimberley and the northern NT regions in our focal area (refer to fig. 2 in Russell-Smith and Sangha (2018) – the black curved lines indicate ABARES regions embedded in the larger ‘productivity’ regions following Bray *et al.* 2015). For Cape York Peninsula and the Queensland Gulf, ABARES (Region 311) largely corresponds with our low productivity region along with an additional small proportion of Qld Central

North (ABARES (Region 313)), for which area-based proportional EBIT (earnings before interest and tax) was used to derive an average EBIT for the combined region. The match between ABARES and our regions is also noted by McLean and Holmes (2019) in their paper.

They further state that we used an average across the entire northern region (page B, column 1 last paragraph), which again is incorrect. For our economic assessment, the region-specific data were used to obtain EBIT and EAIBT (earnings after interest and before tax) for an average pastoral business, as evident from EBIT estimates reported for different regions (Russell-Smith and Sangha 2018; p.317, column 2, paragraph 3 and fig. 2).

The authors contest our results (on page B, column 1 last paragraph) concerning the low productivity of pastoral systems in our focal study area. ‘low’ productivity is in fact clearly evident from fig. 1b, sourced from Tothill and Gillies (1992), and from their own reports (McLean *et al.* 2014; Holmes *et al.* 2017). However, we acknowledge an omission of explaining L, M and H for low, medium, and high productivity regions in Russell-Smith and Sangha (2018; Table 1, page 323).

Incomplete population?

McLean and Holmes (2019) note that we excluded pastoral corporates, which we indicate on p. 317 (column 2, paragraph 2) under the generic statement ‘financial assessments ... were based on long-term data ... for average pastoral businesses in each region, following Holmes *et al.* (2017)’. In so doing we followed McLean *et al.* (2014), Holmes (2015), and Holmes *et al.* (2017). As argued by Holmes (2015; p.613), the decision to: ‘chose to exclude corporate-scale data [in the McLean *et al.* 2014; report was] because it was not well represented across the geographic spectrum of the northern rangelands, was of questionable quality, and was biased by the inclusion of data from non-representative corporate entities. Broad statements that corporate operations are more profitable than smaller family operations in the same region ... need close scrutiny before acceptance because the basis for comparison is not always valid’.

More generally, we note that the sample of family-owned businesses utilised by McLean *et al.* (2014) and Holmes *et al.* (2017) for their assessments would appear to be statistically robust. Although sample and population sizes are not given in Holmes *et al.* (2017), presumably comparable data are included as in McLean *et al.* (2014; Table 1) – for the four ABARES regions which broadly cover our focal study area (W : Ki, N : Vk, N : DTE, Q : Ca), family business sample sizes comprise ~40–50% of the entire population in respective regions.

We also clarify here that our earlier estimate of a gross value AU\$414 million (reported on p. 316 of Russell-Smith and Sangha 2018) relates to average pastoral enterprises in the focal region.

Incorrect reporting of profit after interest?

The authors question why our EAIBT estimates do not fully match theirs. Reasons for this include: (a) as noted above, our assessment regions differed to some extent; and (b) that different interest rates may have been applied. We used a conservative interest rate of 5%, in line with the 6.1% interest rate applied for the Qld Gulf region by Rolfe *et al.* (2016). The interest rate(s)

applied by Holmes *et al.* (2017) are not provided as they used the actual amount of interest reported from ABARES (McLean and Holmes 2019; page B, column 2, paragraph 2).

EBIT per AE for highly productive and less productive pastures?

The authors question first, the application of figures AU\$29/AE for high-, and AU\$10.84/AE for low-productive, regions to assess the net sustainable economic benefits presented in Russell-Smith and Sangha (2018; Table 1). We argue that to develop sustainable beef businesses, we need to understand the potential net returns (EBIT less environmental costs). These were estimated using region-specific carrying capacity data from Tothill and Gillies (1992) for proportional high (5 head/km²) and low (<5 head/km²) carrying capacity areas within each subregion as listed in our Table 1. Then an EBIT of AU\$29/AE or AU\$10.84/AE was applied for respective high or low carrying capacity areas within each subregion to assess total sustainable returns, as presented in Table 1, including environmental costs (details explained in footnotes). The EBIT figure of AU\$29/AE was rationally applied based on average long-term performance of highly productive subregions. An average EBIT of \$10.84/AE across the north that was applied to low productivity subregions actually represents an overestimate as the average of those subregions was only AU\$6.60/AE, suggesting that EBIT estimates given in Table 1 are towards the upper-bound. Table 1 illustrates a scenario of potential cost-benefits for operating sustainable enterprises, in line with the carrying capacity of land, for our focal area.

Second, the authors argue that we portray Barkly, VRD, Kimberley regions as being of 'high' productivity which is incorrect; see Table 1 where Barkly, VRD are listed as 'M' (medium), and Kimberley as 'L' (low). 'High', 'medium' and 'low' are the relative terms used for different regions following Bray *et al.* (2015).

We also highlight that our estimates in Table 1 account for pastoral carrying capacity. Conversely, the financial analyses reported by Holmes *et al.* (2017) and McLean *et al.* (2014) focus on operating scale, not carrying capacity.

The majority of the landscape is operated by profitable businesses?

McLean and Holmes (2019) include 'top performers' in their calculations to support their contention that pastoral businesses across 48% of the landscape are profitable (page C, column 1, paragraph 3) – implying that 52% of the northern landscape supports non-profitable pastoral enterprises. Accepting that 'top performers' tend to be those operating at 'larger scale' (especially >3000 AE: McLean *et al.* 2014; Holmes 2015, Holmes *et al.* 2017), it does not necessarily follow, however, that northern beef businesses can equally demonstrate long-term business sustainability if (a) appropriate environmental liabilities are not taken into account (e.g. Holmes 2015), especially given (b) the generally infertile, low productivity, over-exploited pasture conditions of the 'far north' (Table 1). We consider the very significant issue of appropriate accounting of environmental liabilities further under *Environmental cost*.

Inclusion of owner wages and exclusion of off farm income?

As per our response to *Incomplete populations* above, we note (Russell-Smith and Sangha 2018; p. 317, column 2, paragraph 2) that we followed Holmes *et al.* (2017) in the undertaking of our financial assessments, thereby including owner wages and excluding off-farm income. We consider that the inclusion of owner wages in the manner undertaken by those authors to be entirely appropriate and followed suit.

Exclusion of off-farm income followed McLean *et al.* (2014) and Holmes *et al.* (2017). As argued by McLean *et al.* (2014): [the assessment does] 'not include off-farm income, with the assumption being that the farm business has to be able to meet the personal needs of the owners. Of course, many producers are able to maintain farm business operations and personal needs with other income. This is entirely reasonable and widely observed. However, in a study of this kind, off-farm income is, in fact, a business and/or personal subsidy and should be ignored. Not everyone will agree with this approach, but it is important to state it and provide the reasoning'.

Pastoral industry profitability is not inconsistent with other industries?

We consider this comment irrelevant. Our stated focus is on the status and condition of the northern land sector of which extensive (free range) pastoralism is the dominant land use.

Environmental costs?

As noted previously, understanding and appreciating the environmental liabilities associated with the northern pastoral industry has significant long-term implications for business sustainability and public licence to operate. McLean and Holmes (2019) take issue with our costings associated with two of those liabilities but, as widely recognised, 'costing of other environmental impacts . . . , although feasible to do . . . poses significant challenges – for example, how to put monetary values on biodiversity components and ecologically critical surface and ground-water resources' (Russell-Smith and Sangha 2018; p. 321). What price do we put on the well documented connection between beef cattle (and other ungulate) grazing and impacts on avian granivores (Franklin 1999) and small mammals (Legge *et al.* 2011)?

First, McLean and Holmes (2019) propose that since we account for greenhouse gas emissions from ruminants, it is only reasonable that we should account also for the 'value on the carbon sequestered as a result of woodland thickening across the focal region'. Although this is a somewhat interesting proposition since most rangeland managers and ecologists would argue that woody thickening is actually symptomatic of poor or inappropriate pastoral management (e.g. Burrows *et al.* 2002; Cowley *et al.* 2014; Crowley 2015), we have no in-principle opposition to this suggestion since, in effect, it could support the development of complementary ecosystem service market opportunities especially in pastorally marginal situations. There is, however, evidence for only slight woody thickening across our focal savanna region (Murphy *et al.* 2014), with the notable exception of former grassland and open-woodland systems in Cape York (Crowley and Garnett 1998).

Second, McLean and Holmes (2019) worry that we ‘double count’ the costs of land degradation, where costs for deteriorating ‘B’ and degraded ‘C’ land conditions (following Tothill and Gillies 1992) were estimated (very conservatively) from losses in pasture production and subsequent cattle returns, i.e. EBIT/year (in line with, for example, Scanlan *et al.* 2013; Bray *et al.* 2015). However, land degradation costed in this manner accounts only for the annual opportunity cost to the pastoral enterprise, and not for the decadal scale impacts on local and downstream processes and industries (e.g. Caitcheon *et al.* 2012; Brodie and Pearson 2016), let alone for rehabilitation of the pasture and soil resource should that even be possible. As noted by Crowley (2015), pastoral lease conditions of the three northern jurisdictions require the lessee to exercise a duty of care towards maintaining and improving resource condition. Moreover, taking into account the broader costs on ecosystem services when applying authoritative accounting processes associated with land degradation (e.g. ELDI 2015), the imputed costs of pastoral land

degradation across our focal region is estimated at \$3billion dollars per annum (Russell-Smith *et al.* 2019; Table 5.5). By any reasonable measure, the environmental liabilities of the far northern pastoral industry are immense if yet to be appropriately quantified.

Land sector development opportunities

Based on extensive experience, respected northern pastoral industry business advisors argue persuasively that fine-honed business skills are both essential and typically lacking in most family run beef enterprises (e.g. refer to quotes in Table 1; Holmes 2015; p. 615; Rolfe *et al.* 2016; p. 270). Although not disagreeing at all with the importance of these observations, we simply contend, as evidenced both in our earlier treatments and here, that broader sustainable land sector development in northern Australia must address: (a) well documented challenges confronting the economic viability and long-term sustainability of many far northern beef cattle

Table 2. Key challenges to developing a diversified northern Australia land sector

Issue	Comments
Inconsistent policy settings in the three northern jurisdictions concerning diversification opportunities on pastoral leases	<ul style="list-style-type: none"> • The Commonwealth Government’s recent Northern Development White Paper (Commonwealth of Australia 2015; p. 34) notes that ‘while some jurisdictions have more flexible arrangements than others, pastoral leaseholders often face a number of challenges’, including: land use restrictions for other than grazing; often requiring approvals from various government bodies; reduced investment security (see Commonwealth of Australia 2015; p. 34–38) • The Northern Development White Paper proposes that such key regional policy issues (and others, see below) could be effectively addressed through the Northern Australia Strategic Partnership, including biannual meetings of the Ministerial Forum on Northern Development involving Federal and State Ministers and agencies, and two advisory groups, an Indigenous Reference Group, and a more broadly based North Australia Advisory Council (Commonwealth of Australia 2015; p. 10; Office of Northern Australia 2019) • In supporting the above initiative, Dale (2019) notes also (1) the importance of engaging also with regional planning and local government initiatives, but (2) ‘the lack of cohesive vision in the white paper concerning the role of Indigenous people. . .and the lack of clear pathways and strategies for supporting the development aspirations of Traditional Owners’ (<i>ibid</i>: p. 218)
Addressing the complexities, time constraints and uncertainties that can be associated with Native Title, multi-tenured arrangements	<ul style="list-style-type: none"> • The Northern Development White Paper notes ‘Importantly, pastoral leases and native title rights co-exist over Australia’s north. Broadening and securing these leases through negotiation will create opportunities for partnership that benefit both Indigenous and non-Indigenous people’ (Commonwealth of Australia 2015; p. 34) • Given that Native Title is too often seen as a barrier to, rather than an opportunity for, economic development benefiting all title holders, the White Paper outlines various initiatives and processes for expediting negotiation processes (Commonwealth of Australia 2015; p. 18–29). From a practical land management perspective perhaps the most innovative of those initiatives is the commitment to support pilot (or demonstration) activities (<i>ibid</i>: p. 17–18)—for case example, supporting economic diversification activities on pastoral lands in multi-tenured settings • The above facilitating roles identified for the Ministerial Forum on Northern Development, and engagement of other regional and local governance bodies, also apply here
Inconsistent policy settings between the three northern jurisdictions, and the Commonwealth, concerning carbon rights legislation	<ul style="list-style-type: none"> • Carbon rights serve as a prime example of the dysfunctional regulatory framework that currently applies to affect the development of ecosystem services opportunities across the North—refer Dore <i>et al.</i> (2014) for the different regulatory frameworks applying both to (a) Native Title holders, pastoral lessees, and freehold landowners, and (b) savanna burning emissions abatement and sequestration projects, in (c) respective northern jurisdictions • The role of the Commonwealth is also pivotal given provisions of the <i>Carbon Farming Initiative Act (2011)</i>, and subsequent amendments, particularly with respect to treatment of sequestration projects involving Native Title—refer Dore <i>et al.</i> (2014) for initial details • The above facilitating roles identified for the Ministerial Forum on Northern Development, and engagement of other regional and local governance bodies, could also apply here
Progressing development of ecosystem services metrics and markets	<ul style="list-style-type: none"> • As acknowledged in Russell-Smith and Sangha (2018; p. 327), although ‘significant technical and policy challenges’ remain, there is already ‘a substantial diversity of foundational work. . .now being progressed’
Engaging the far northern pastoral industry in ecosystem service market opportunities	<ul style="list-style-type: none"> • Substantial work is required to address first the above actual and perceived policy barriers • The commitment to support practical pilot (or demonstration) economic diversification activities (Commonwealth of Australia 2015; p. 17–18) would also assist to overcome such barriers

enterprises; (b) 'far from being a landscape endowed with homogenous high pastoral potential. . . north Australia instead supports very significant cultural, biodiversity conservation, and global carbon stock values, which contribute significantly to the socioeconomic wellbeing of local and regional communities' (Russell-Smith and Sangha 2018; p. 323); and (c) opportunities are rapidly emerging to engage with a range of ecosystem services enterprise options that hitherto have not been available.

Given McLean and Holmes' (McLean *et al.* 2014; Holmes *et al.* 2017) business focus on the northern pastoral estate it is important to note that we are not suggesting that beef cattle production and ecosystem services are necessarily mutually exclusive enterprise activities; rather, it is realistic to consider that different enterprise options might be pursued in appropriate locations either on individual properties, or regionally. Savanna burning projects, for example, can be undertaken complementarily with cattle production in marginal settings both on individual properties, or under multi-tenured arrangements – collaborations between Indigenous and non-Indigenous title holders to derive mutual benefits.

In promoting such a diversification agenda we are mindful that many in the pastoral industry will be doubtful, dismissive even – especially given the recognised conservatism and traditionalism of many producers (McLean *et al.* 2014; Holmes 2015; Rolfe and Gregg 2015; Rolfe *et al.* 2016; Holmes *et al.* 2017). However, just as there are significant challenges confronting the profitability and long-term sustainability of the northern pastoral sector (Table 1), so too are there very significant policy and practical implementation challenges needing to be addressed (Table 2). Regardless, we remain encouraged by the extraordinary take up of savanna burning opportunities in recent years, the strength of regional ecotourism, and growing recognition of the international significance of the north Australian cultural and conservation economy. Beneficial change is required and possible.

Conflicts of interest

The authors declare no conflicts of interest.

Acknowledgements

We thank anonymous reviewers for their constructive criticisms and professional insights, and the editor of *The Rangeland Journal* for facilitating this timely discussion. This contribution is part of a broader research collaboration addressing the building of resilience in remote north Australian communities, undertaken under the auspices of the Bushfire and Natural Hazards Cooperative Research Centre, Melbourne.

References

ABARES (Australian Bureau of Agricultural and Resource Economics and Sciences) (2014). 'Regional farm debt: northern Queensland gulf, South West Queensland and North West New South Wales.' (ABARES: Canberra, ACT.)

ABARES (Australian Bureau of Agricultural and Resource Economics and Sciences) (2017). Farm Survey Data for the beef, slaughter lambs and sheep industries. MLA database. Available at: <http://apps.daff.gov.au/MLA/> (accessed 10 May 2019).

Archer, R., Russell-Smith, J., Kerins, S., Costanza, R., Edwards, A., and Sangha, K. (2019). Change and continuity: the north Australia cultural landscape. In: 'Sustainable Land Sector Development in Northern Australia: Indigenous Rights, Aspirations, and Cultural Responsibilities'. (Eds J. Russell-Smith, G. James, H. Pedersen and K. Sangha.) pp. 9–34. (CRC Press: Boca Raton, FL, USA.)

Ash, A. J., McIvor, J. G., Mott, J. J., and Andrew, M. H. (1997). Building grass castles: integrating ecology and management of Australia's tropical tallgrass rangelands. *The Rangeland Journal* **19**, 123–144. doi:10.1071/RJ9970123

Brann, M. (2016). Agribusinesses generate more than \$28M for Indigenous Land Corporation. Available at: <https://www.abc.net.au/news/rural/2016-11-15/ilc-annual-report-shows-agribusiness-success/8022810> (accessed 19 June 2019).

Bray, S., Walsh, D., Hoffmann, M., Henry, B., Eady, S., Collier, C., Pettit, C., Navarro, J., and Corbet, D. (2015). Desktop research project to provide data on liveweight and liveweight gain in the beef cattle sector in Queensland and the Northern Territory. Final report, 2015. Department of Agriculture and Fisheries, Rockhampton, Qld.

Brodie, J., and Pearson, R. G. (2016). Ecosystem health of the Great Barrier Reef: time for effective management action based on evidence. *Estuarine, Coastal and Shelf Science* **183**, 438–451. doi:10.1016/j.ecss.2016.05.008

Burrows, W. H., Henry, B. K., Back, P. V., Hoffmann, M. B., Tait, L. J., Anderson, E. R., Menke, N., Danaher, T., Carter, J. O., and McKeon, G. M. (2002). Growth and carbon stock change in eucalypt woodlands in northeast Australia: ecological and greenhouse sink implications. *Global Change Biology* **8**, 769–784. doi:10.1046/j.1365-2486.2002.00515.x

Caitcheon, G. G., Olley, J. M., Pantus, F., Hancock, G., and Leslie, C. (2012). The dominant erosion processes supplying fine sediment to three major rivers in tropical Australia, the Daly (NT), Mitchell (Qld) and Flinders (Qld) Rivers. *Geomorphology* **151–152**, 188–195. doi:10.1016/j.geomorph.2012.02.001

Commonwealth of Australia (2015). 'Our North, Our Future: White paper on developing Northern Australia.' (Commonwealth Government: Canberra.)

Cowley, R., Hearnden, M., Joyce, K., Tovar-Valencia, M., Cowley, T., Pettit, C., and Dyer, R. (2014). How hot? How often? Getting the fire frequency and timing right for optimal management of woody cover and pasture composition in northern Australian grazed tropical savannas. Kidman Springs fire experiment 1993–2013. *The Rangeland Journal* **36**, 323–343. doi:10.1071/RJ14030

Cowley, R., Walsh, D., and Douglas, J. (2017). Simulated impacts of wet season spelling and intensive rotational grazing on pasture condition in a degraded northern Mitchell grass savanna. In: 'Proceedings of the 19th Australian Rangeland Biennial Conference'. (Australian Rangeland Society: Mount Lawley: WA.)

Crowley, G. M. (2015). 'Trends in Natural Resource Management in Australia's Monsoonal North: The Beef Industry.' (The Cairns Institute, James Cook University: Cairns, Qld.)

Crowley, G. M., and Garnett, S. T. (1998). Vegetation change in the grasslands and grassy woodlands of east-central Cape York Peninsula, Australia. *Pacific Conservation Biology* **4**, 132–148. doi:10.1071/PC980132

Dale, A. (2019). Governing north Australia landscapes for a better future. In 'Sustainable Land Sector Development in Northern Australia: Indigenous Rights, Aspirations, and Cultural Responsibilities'. (Eds J. Russell-Smith, G. James, H. Pedersen and K. Sangha.) pp. 203–221. (CRC Press: Boca Raton, FL, USA.)

Dore, J., Michael, C., Russell-Smith, J., Tehan, M., and Caripes, M. (2014). Carbon projects and Indigenous land tenure in northern Australia. *The Rangeland Journal* **36**, 389–402. doi:10.1071/RJ13128

- ELDI (Economics of Land Degradation Initiative) (2015). The value of land: prosperous lands and positive rewards through sustainable land management. ELD Secretariat, Bonn, Germany. Available at: www.eld-initiative.org (accessed 10 May 2019).
- Franklin, D. C. (1999). Evidence of disarray amongst granivorous bird assemblages in the savannas of northern Australia, a region of sparse human settlement. *Biological Conservation* **90**, 53–68. doi:10.1016/S0006-3207(99)00010-5
- Holmes, P. (2015). Rangeland pastoralism in northern Australia: change and sustainability. *The Rangeland Journal* **37**, 609–616. doi:10.1071/RJ15051
- Holmes, P., McLean, I., and Banks, R. (2017). The Australian Beef Report. Bush AgriBusiness Pty Ltd: Toowoomba, Qld.
- Kerins, S., and Green, J. (2019). Like a rusty nail, you can never hold us blackfellas down; cultural resilience in the southwest Gulf of Carpentaria. In: 'Sustainable Land Sector Development in Northern Australia: Indigenous Rights, Aspirations, and Cultural Responsibilities'. (Eds J. Russell-Smith, G. James, H. Pedersen and K. Sangha.) pp. 177–200. (CRC Press: Boca Raton, FL, USA.)
- Legge, S., Kennedy, M., Lloyd, R., Murphy, S., and Fisher, A. (2011). Rapid recovery of mammal fauna in the central Kimberley, northern Australia, following the removal of introduced herbivores. *Austral Ecology* **36**, 791–799. doi:10.1111/j.1442-9993.2010.02218.x
- McKeon, G. M., Stone, G. S., Syktus, J. I., Carter, J. O., Flood, N. R., Ahrens, D. G., Bruget, D. N., Chilcott, C. R., Cobon, D. H., Cowley, R. A., Crimp, S. J., Fraser, G. W., Howden, S. M., Johnston, P. W., Ryan, J. G., Stokes, C. J., and Day, K. A. (2009). Climate change impacts on northern Australian rangeland livestock carrying capacity: a review of issues. *The Rangeland Journal* **31**, 1–29. doi:10.1071/RJ08068
- McLean, I., and Holmes, P. (2019). The contribution of the pastoral industry to a diversified land sector economy in northern Australia. *The Rangeland Journal* **41**, 157–160. doi:10.1071/RJ18098
- McLean, I., Holmes, P., and Counsell, D. (2014). 'The Northern Beef Report. 2013 Northern Beef Situation Analysis.' (Meat & Livestock Australia: North Sydney, NSW.)
- Meat and Livestock Australia (2017). Fast facts: Australia's beef industry. Available at: <https://www.mla.com.au/prices-markets/Trends-analysis/fast-facts/> (accessed 10 January 2018).
- Murphy, B. P., Lehmann, C. E. R., Russell-Smith, J., and Lawes, M. J. (2014). Fire regimes and woody biomass dynamics in Australian savannas. *Journal of Biogeography* **41**, 133–144. doi:10.1111/jbi.12204
- O'Reagain, P., Scanlan, J., Hunt, L., Cowley, R., and Walsh, D. (2014). Sustainable grazing management for temporal and spatial variability in north Australian rangelands – a synthesis of the latest evidence and recommendations. *The Rangeland Journal* **36**, 223–232. doi:10.1071/RJ13110
- ONA (Office of Northern Australia) (2019). Northern Australia Ministerial Forum. Available at: <https://www.industry.gov.au/about-us/our-structure/office-of-northern-australia> (accessed 20 June 2019).
- Preece, L. D., van Oosterzee, P., Dungey, K., Standley, P.-M., and Preece, N. D. (2016). Ecosystem service valuation reinforces world class value of Cape York Peninsula's ecosystems but environment and Indigenous people lose out. *Ecosystem Services* **18**, 154–164. doi:10.1016/j.ecoser.2016.03.001
- Rolfe, J., and Gregg, D. (2015). Factors affecting adoption of improved management practices in the pastoral industry in Great Barrier Reef catchments. *Journal of Environmental Management* **157**, 182–193. doi:10.1016/j.jenvman.2015.03.014
- Rolfe, J. W., Larard, A. E., English, B. H., Hegarty, E. S., McGrath, T. B., Gobius, N. R., DeFaveri, J., Srhoj, J. R., Digby, M. J., and Musgrove, R. J. (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. doi:10.1071/RJ15093
- Rural Bank Ltd (2016). Australian farmland values 2015. Available at: www.ruralbank.com.au/news/view/australian-farmland-values-2015 (accessed 12 January 2018).
- Rural Industries Research and Development Corporation and McClelland Rural Services Pty Ltd (2012). Managing Indigenous pastoral lands: Case study 2 – Delta Downs station Queensland. RIRDC and McClelland Rural Services Pty Ltd, Birkdale Qld.
- Russell-Smith, J., and Sangha, K. K. (2018). Emerging opportunities for developing a diversified land sector economy in Australia's northern savannas. *The Rangeland Journal* **40**, 315–330. doi:10.1071/RJ18005
- Russell-Smith, J., Sangha, K. K., Costanza, R., Kubiszewski, I., and Edwards, A. (2019). Towards a sustainable diversified land sector economy for north Australia. In: 'Sustainable Land Sector Development in Northern Australia: Indigenous Rights, Aspirations, and Cultural Responsibilities'. (Eds J. Russell-Smith, G. James, H. Pedersen and K. Sangha.) pp. 85–132. (CRC Press: Boca Raton, FL, USA.)
- Sangha, K. K., Edwards, A. C., and Russell-Smith, J. (2019). Valuing the north Australian conservation estate (Box 4.5 in Chapter 4). In: 'Sustainable Land Sector Development in Northern Australia: Indigenous Rights, Aspirations, and Cultural Responsibilities'. (Eds J. Russell-Smith, G. James, H. Pedersen and K. Sangha.) pp. 78–79. (CRC Press: Boca Raton, FL, USA.)
- Scanlan, J. C., MacLeod, N. D., and O'Reagain, P. J. (2013). Scaling results up from a plot and paddock scale to a property – a case study from a long-term grazing experiment in northern Australia. *The Rangeland Journal* **35**, 193–200. doi:10.1071/RJ12084
- Tohill, J. C., and Gillies, C. (1992). 'The Pasture Lands of Northern Australia: Their Condition, Productivity and Sustainability.' (Tropical Grassland Society of Australia Inc.: Brisbane, Qld.)