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GrazingFutures: learnings from a contemporary collaborative extension program in rangeland communities of western Queensland, Australia

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Abstract. Producer reliance on drought subsidies instead of proactive planning and timely destocking in low rainfall years has prompted Queensland government investment in promoting business and drought resilience. GrazingFutures (AU$6 million budget, 2016–2022) is an extension project focussed on enhancing business management skills of extensive livestock producers in western Queensland, Australia. The region's rangelands are in productivity decline, span 1 million km^2 and are managed by graziers operating more than 2400 livestock businesses (beef, sheep and goats). The Queensland Department of Agriculture and Fisheries delivers GrazingFutures as a component of the Drought and Climate Adaptation Program, in partnership with regional natural resource management groups and other public and private organisations. Project delivery emphasised upskilling multi-agency staff and livestock producers to promote practice change within three whole of business themes: (1) grazing land management; (2) animal production; and (3) people-business. Three independent surveys (2018, 2019, 2020) indicated positive practice change was occurring in grazing businesses as a consequence of the project. Graziers instigated management changes even under major environmental challenges including extended drought (2013–2020), an extreme flood event in 2019 and the COVID-19 pandemic in 2020. This paper details the rationale, progress against the objectives, challenges and future direction of the GrazingFutures extension project.

Keywords: drought management, risk, partnerships, training, rainfall variability, seasonal variability, stocking rates, wet season spelling, land condition, climate forecasting, grazier decision making, rural communities.

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Background

Australian rangelands and the livestock industries (beef, sheep, goats) dependent on them are susceptible to climate extremes (Reid and Thomas 1973; Buxton and Stafford-Smith 1996; Ash *et al.* 2007). In western Queensland, as in semi-arid zones elsewhere, deft stocking rate and business management is critical in coping with variable seasonal rainfall and regular droughts (Buxton and Stafford-Smith 1996). Although conservative grazing management is widely advocated (McKeon *et al.* 1990; Hunt 2008; Orr and O'Reagain 2011; Hunt *et al.* 2014; Rolfe *et al.* 2016), poor drought management, overstocking and slow management responses to dry conditions continue to undercut landscape resilience, pasture productivity, carrying capacity, animal productivity and ultimately, the financial viability of individual enterprises and regional economies (Shaw *et al.* 2007; Holmes 2015; Rolfe *et al.* 2016; Holmes *et al.* 2017*a*). Although regionally specific data are sparse, grazier resistance to adoption of best management practice has been observed across the extensive grazing landscapes of western Queensland, even when the practice is underpinned by science, and has demonstrated financial benefit (Marshall *et al.* 2011; Rolfe and Gregg 2015; Star *et al.* 2015; Turner *et al.* 2017).

The Queensland Drought Relief Assistance Scheme (DRAS; Queensland Government 2020*c*) subsidies for freight, fodder and water infrastructure are being phased out in preference to programs promoting drought preparedness over crisis response

(Botterill and Hayes 2012). Such a transition relies on reversing the decline in extension support services, particularly in drought-prone western Queensland. The 2016 Drought and Climate Adaptation Program (DCAP; Queensland Government 2020*d*) was launched, combining nine research and development and extension (RD&E) drought resilience projects. One of these projects, GrazingFutures, was the primary extension arm to revitalise western Queensland advisory services, connect the livestock industry to DCAP decision support tools and help graziers build landscape and business resilience. This paper describes the unique and purposeful combination of multi-agency collaboration, staff training and whole of business (WOB) industry services (Rolfe *et al.* 2016) within GrazingFutures. Through this approach, the GrazingFutures achievements in changing land, livestock and drought management decision-making surpass those of previous climate and industry projects in western Queensland. Finally, the effectiveness of the project and future areas of improvement are discussed.

Materials and methods

Site description

GrazingFutures covers 60% of Queensland and the project is managed as three regions (North, Central and South Queensland) across four natural resource management (NRM) catchment groups and regions (Fig. 1): Northern Gulf Resource Management Group (NGRMG) and Southern Gulf NRM (SGNRM) in the North; Desert Channels Queensland (DCQ) in the Central; and the western portion of Southern Queensland Landscapes (SQL) in the South. Annual average rainfall (350–800 mm) is inversely correlated with variability (from 35 to ~65% CV) from north to south and is summer dominant (Fig. 1). The native pasture communities include Gulf savannahs in the north, treeless Mitchell grasslands in a broad arc from the north-west to the south-east, floodplain and desert spinifex pastures in the far west, Eucalypt spinifex woodlands on poor and sandy soils, and mulga (*Acacia aneura*) woodlands in the south (Weston 1988). Since 2013, parts of the North region have been drought declared for 3–4 years, while almost continuous drought declarations have prevailed across Central and South regions over the same period.

Agricultural production accounts for 82% of income with annual livestock and livestock product sales from 2470 grazing business (North = 430, Central = 740 and South = 1300) reaching AU$2 billion (Table 1; ABS 2019*a*, 2019*b*). The region carries one-third of Queensland's cattle herd (MLA 2019*a*) and 60% of its merino sheep flock (MLA 2019*b*). Herd performance (weaning, death and growth rates) drives profit, equity building and thus business resilience. Regional herd production efficiencies are well described (Bortolussi *et al.* 2005*a*, 2005*b*; Rolfe *et al.* 2016), and while highly dependent on seasonal biomass, there is considerable scope for graziers to improve their herd management and stocking rate decisions in response to poor seasonal conditions.

Flow on effects of drought in Queensland's regional economies are relatively underreported but significant. From 2013–2017 in the central-west, agricultural contribution to the regional economy shrank from 50% to 25%. Approximately, 1300 people (12% of the population) migrated to larger centres seeking employment (Kelly and Phelps 2019). Regional unemployment in shires across western Queensland ranged from 2.7% to 29.5% (QGSO 2020), compared with the state average of 6.1%, reflecting their economic dependence on 'rain fed' agricultural production (IPCC 2007; Phelps and Kelly 2019).

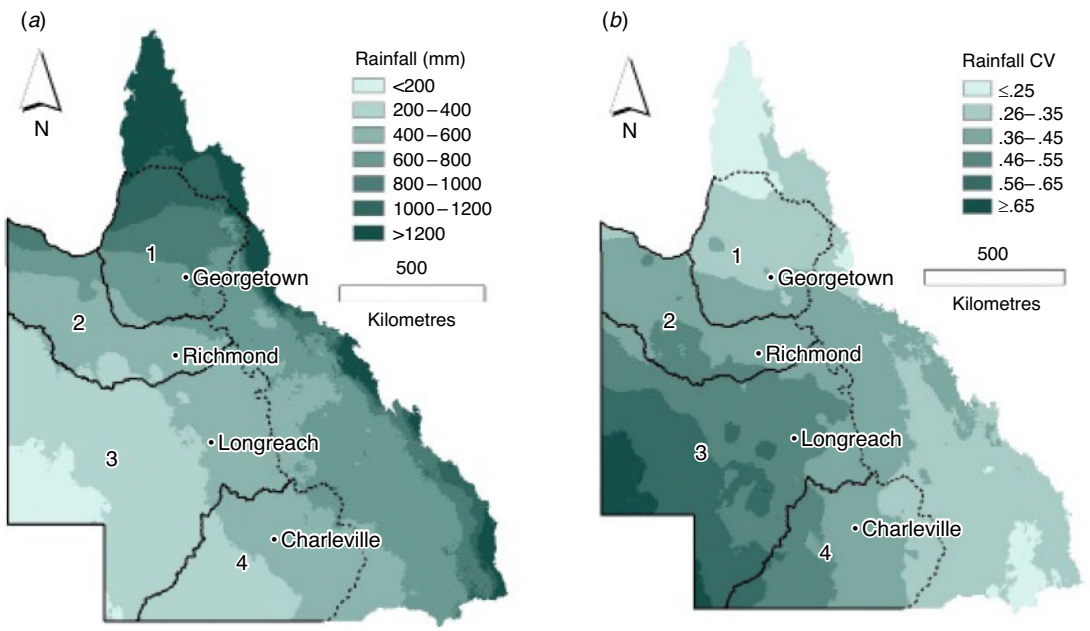

Fig. 1. The GrazingFutures project region includes the catchment or part catchment boundaries of four natural resource management (NRM) regions: (1) NGRMG, (2) SGNRM, (3) DCQ, and (4) SQL. The average annual rainfall (*a*) and rainfall coefficient of variation (CV) (*b*) is also highlighted. The dashed eastern boundary represents the flexibility in GrazingFutures delivery to service drought affected graziers adjacent to the catchment boundaries.

Table 1. Australian Bureau of Statistics data for land use, farm demographics, livestock and value of production within the main NRM regions of focus for the GrazingFutures project (ABS 2019*a*, 2019*b*)

Category	Northern Gulf	Southern Gulf	Desert Channels	South West Queensland	Overall
		LAND USE (ha)			
Area used for grazing	9586129	15525435	36948585	15139692	77199842
LAND MANAGER DEMOGRAPHICS					
Average age (years)	54	58	56	56	56
Years in farming	33	41	37	36	37
No. owner/operators	283	248	674	417	1622
No. managers or other	37	31	31	-	99
FARM INCOME SOURCE (%)					
Agricultural production on holding	84	82	82	78	82
Off-farm employment/business activities	9	3	11	16	9
Other sources	6	5	5	5	5
Grants, government transfers, relief funding	1	10	3	1	4
LIVESTOCK CARRIED (number)					
Beef cattle	735522	1202956	1307283	413201	3658962
Sheep	16152	61020	913162	396475	1386810
All other livestock	3821	9913	220	54418	68372
VALUE OF PRODUCTION (sale value in AU$)					
Cattle	383051736	625581569	672581010	215843438	1897057754
Sheep	161809	617658	7726118	3932333	12437918
All other livestock	557057	1456714	–	8067943	10081714
Wool	828374	3127943	46836714	20332741	71125772
Other livestock products	–	16758	–	2296565	2313323
Total livestock and product sales	**384598976**	**630800642**	**727143843**	**250473020**	**1993016481**

GrazingFutures purpose

The difficulties of many graziers to operate sustainable livestock operations in western Queensland's variable rainfall environment negatively affects profitability, rangeland productivity, grazier mental health and the prosperity of regional communities. Insights from rural specialists (McCartney 2017) indicated that drought subsides legitimise overstocking practices and constrain beneficial practice change for many graziers. Consequently, a government focus to re-build regional extension services and improve inter-agency collaboration emerged to transition from subsidies to industry self-reliance. The purpose of GrazingFutures is to increase and better align inter-agency extension support through the grazing land management (GLM), animal production and people–business pillars of the livestock operation, and the four objectives of GrazingFutures include: (1) *partnering* (government and non-government); (2) *staff training*; (3) *service delivery to* graziers; and (4) assembling project and industry *legacy* (*information*) *products* (Fig. 2).

(1) Partnering to support grazing businesses

GrazingFutures is the livestock industry engagement and advisory component of the DCAP partnership between the Queensland Departments of Agriculture and Fisheries (DAF), Environment and Science (DES) and the University of Southern Queensland (USQ). To better align inter-agency delivery and integrate emerging research messages from key DCAP projects, GrazingFutures brokered formal partnerships between DAF and the four groups regional representing the NRM regions (Fig. 1) within the project area. Additional partnerships (with industry advocacy bodies, Rural Financial Counselling Service (RFCS), regional agri-businesses, Royal Flying Doctor Service (RFDS), community mental health providers and local councils) fostered under the GrazingFutures umbrella enhanced the overall service provider response to producer and community needs. In all, 38 Department of Agriculture and Fisheries (DAF) staff (~20 full time equivalents; FTE) and 77 (~16 FTE) partner and collaborator staff combined their industry, production, business, NRM, communication and mental health expertise to work with and assist livestock producers.

(2) Staff training

GrazingFutures inspired and funded additional professional development of young and early career employees to enhance the advisory capacity of public and private sector service providers in western Queensland. The Long Paddock (2017) surveyed 29 GrazingFutures staff from 10 organisations to identify their existing advisory skills and future training needs. Staff training preferences included gaining confidence in group facilitation and one-on-one extension, and a better understanding of land types, safe stocking rates, supplement programs, herd management, record keeping, herd modelling and marketing. Subsequently, staff professional development was provided by the project through programmed learning packages (nutrition, grazing, breeding and business), webinar training sessions, mentoring by senior staff during GrazingFutures events and on-property sessions, and on-going technical coaching by external and internal project mentors. Mental health and wellbeing training was also delivered to service providers supporting drought and flood affected (Cowan *et al.* 2019) graziers. During 2019–2020, GrazingFutures staff and project partners participated in 193 professional development opportunities to enhance

Fig. 2. The GrazingFutures operating environment, project cycle and objectives.

their skills and confidence in extension and livestock production systems. A follow-up skills survey will be conducted in late 2021.

(3) Service delivery

GrazingFutures activities focussed on providing information and extension support to graziers in pursuit of drought resilience across the WOB themes (grazing, production and people–business). GrazingFutures embraced a suite of extension techniques (Coutts and Roberts 2003) including: (1) programmed learning utilising established industry training packages (DBIRD, QDPIF and DNRM 2002); (2) information access through industry forums, neighbour days, newsletters and case studies; (3) one-on-one grazier mentoring and on-property support; (4) on-property demonstrations featuring emerging industry technologies; and (5) eExtension and online learning modes. Due to the exceptional circumstances surrounding the COVID-19 pandemic throughout 2020, online learning platforms were used extensively for project communications and on-going service delivery to graziers.

At the time of writing, a total of 156 training workshops, 32 field days, 144 industry forums, 12 facilitated grazier groups and 420 one-on-one grazier support activities have been delivered, while five on-property sown pasture, grazing management and Walk Over Weighing (WOW; Black 2016) demonstrations have been established since the commencement of GrazingFutures in 2016.

A monitoring, evaluation, reporting and improvement (MERI) plan was developed to coordinate and appraise GrazingFutures project events and services (Roberts and Long 2017). Grazier feedback sheets captured participant details, changes in knowledge, attitudes, skills and aspirations (KASA) (Bennett 1975). The likelihood of implementing practice changes after participating in a GrazingFutures activity was measured using a market research intent scale (Risen and Risen 2008), which translate respondents' intentions to purchase into the probability of purchase (where 'implementing practice change' is the purchase). Graziers elected their likelihood of implementing practice change on a scale 1–7 (1 = highly unlikely; 4 = not sure; 7 = highly likely) (Preston and Colman 2000).

(4) Legacy products

Graziers may reject industry-wide research findings and recommendations, partly due to the perceived uniqueness of their properties (Lyon *et al.* 2011) but are more likely to adopt new practices received through peer to peer or local knowledge (Greiner and Gregg 2011; Lyon *et al.* 2011) or delivered through landholder-driven approaches (Willis *et al.* 2017). GrazingFutures addressed this through the production and distribution of legacy products. Legacy products refer to narratives, case studies, fact sheets, web page products and documented grazier-endorsed best practices that act as enduing insights into project achievements and sustainable management of extensive livestock businesses. Of the narratives and case studies, 15 linked to GLM, 20 to animal production, 10 to people–business and six to staff capacity building and partner collaboration. Four Excel calculators (agistment or paddock leasing, costing nutrients, feeding margins and pasture budgeting), 11 web pages, one fact sheet and one grazier booklet have been published. GrazingFutures legacy products are widely promoted through GrazingFutures partner networks, and the FutureBeef platform (www.futurebeef.com.au; Facebook, Twitter and eBulletin subscribers).

Results

Partnerships and up-skilled delivery teams

GrazingFutures exists in an era where publicly funded rural advisory and extension support in Queensland, once an integral

part of rural services, receive fewer resources and increasingly work in tandem with private sector advisory services (Coutts *et al*. 2019). The large geographical area and low population density of the GrazingFutures region requires integration of services among government, industry and community organisations, encouraging a mindset of collaboration over competition. In early 2020, a pilot NRM survey was conducted with representatives from North region NRM groups to assess the functionality and effectiveness of GrazingFutures government and non-government partnerships (Roberts 2020). These surveys indicated that GrazingFutures partnerships were viewed positively, and specialist technical services (pastures, reproduction and business) and grazier networks provided by DAF were valued by NRM partners.

Livestock extension services in western Queensland have doubled since 2015, due mainly to the GrazingFutures project. Positive inter-agency collaboration and successful multi-partner industry events and services (workshops, field days, one-on-one support and on-property demonstrations) were documented in 14 of the GrazingFutures legacy products. The DCAP program funded several projects, four of which GrazingFutures actively collaborated with and contributed to (Table 2). The inter-project collaboration included GrazingFutures staff connecting DCAP project teams to local grazier networks, industry events and production data, while the skills of GrazingFutures extension teams were enhanced through the DCAP forage and climate tools, social and behavioural science insights and costed-drought management strategies.

Effective extension staff appreciate the intricacies of family livestock businesses and the often complex social and advisory network that contributes to family farm decision making (Pannell and Vanclay 2011). Much of GrazingFutures success has been built on local industry support staff familiar with family-owned livestock businesses, their community and regional landscapes. Somewhat uniquely for each region, GrazingFutures supports staff from multiple organisations (NRM, Agribusiness, RFCS, RFDS, mental health providers and local councils) who work with livestock producers. Furthermore, on-the-job learning and mentoring in GLM, animal production and people-business has seen participating officers improve their capacity to provide general social and wellbeing support, as well as Mental Health First Aid (MHFA), to the industry, particularly in response to recent and ongoing flood and drought events. Collaboration with those providing psychosocial services highlights the importance of focusing on people and communities in this project.

Industry practice change and drought preparedness

At the time of writing, 3595 people including 2778 graziers (2136 livestock businesses), have participated in GrazingFutures events since 2016. This included over 420 livestock businesses who received on-property, online or phone one-on-one support services. Activity feedback sheets indicated that 27% of these participants reported management changes in KASA. Of the graziers, 26% intended to make a change, while practice change was highly likely to be implemented on 10% of livestock businesses within 12 months of the event (Table 3). Practice change resulting from GrazingFutures events and one-on-one support included but was not limited to herd structure adjustments, livestock marketing, livestock nutrition, stocking rates and weaner management, as well as the use of seasonal forecasting, wet season spelling and financial–livestock recording systems.

Roberts (2018, 2019, 2020) surveyed participating graziers using face to face and telephone interviews in 2017 ($n = 57$), 2019 ($n = 45$) and 2020 ($n = 45$). The North region was absent from the 2019 survey due to a catastrophic flooding event (Cowan *et al*. 2019). Survey questions assessed grazier intention to make a change, the types of changes made (in GLM,

Table 2. Inter-project collaboration within the Drought and Climate Adaptation Program (DCAP) partnership between the Department of Agriculture and Fisheries (DAF), Department of Environment and Science (DES) and University of Southern Queensland (USQ)

GrazingFutures staff assisted social science (DES 3), economic modelling (DAF 6), remote sensing (DES 1) and climate forecasting (USQ 4) teams, and promoted their research and decision support tools to extensive livestock producers

Drought and Climate Adaptation Program collaborative project	GrazingFutures provided:	GrazingFutures received:
DES 1 (*The inside edge for graziers to master Queensland's drought prone climate*)	• Links to co-operating properties (5) and assisted with fieldwork logistics. • Demonstration site data (faecal, pasture and liveweight performance) provided for modelling purposes.	• Forage tools for GrazingFutures staff to use in extension activities. • Long-term carrying capacity tools for graziers.
USQ 4 (*The North Australia Climate Program*, *NACP*)	• Joint delivery of climate forecasting workshops. • Production of climate webinars for graziers and industry service providers.	• NACP staff (Climate Mates) joining GrazingFutures teams and assisting with industry service delivery.
DAF 6 (*Deliver integrated production and economic knowledge and skills to improve drought management outcomes for grazing systems*)	• Interrogated and refined regional assumptions and modelled scenarios. • Evaluated benefits of strategies for livestock producers.	• GrazingFutures staff used regional data to help graziers consider riskiness, feasibility and profitability of particular management strategies.
DES 3 (*Enabling drought resilience and adaptation*: *A program of social research and knowledge support*)	• Links to 46 specialists and nine graziers for insights into drought decision making. • Support with 40 grazier interviews (80 graziers) on drought decision making.	• Combined, the DES 3 reports guided GrazingFutures regional planning activities and industry service delivery.

Table 3. Grazier and non-grazier participation in GF events (2016–2020) and their feedback indicating changes in knowledge, attitude, skills and aspirations (KASA), intention to change and likelihood of practice change 12 months post event

Participation in GrazingFutures activities and attendee feedback	Total
Grazier attending GrazingFutures events (livestock businesses)[A]	2778 (2136)
Non-grazier attending GrazingFutures events[A]	817
Changes in knowledge, attitudes, skills and aspirations (KASA)[B] (graziers and non-graziers)	964
Intention to change (graziers)[B]	726
Highly likely a practice change will be implemented (livestock businesses)[C]	202

[A]Attendance and changes in KASA as recorded at GF events.
[B]Intention to change (yes, no or unsure) as recorded on feedback sheets.
[C]Estimated from grazers selecting 'very likely' (on feedback sheets) to make a practice change within the next 12 months.

animal production and people-business) and overall improvement in the drought preparedness elements of a grazing business (Fig. 3).

The surveys found that the majority (56–82%) of participants were considering changes to their livestock operation after participating in a GrazingFutures activity. Intended practice changes primarily comprised of herd productivity strategies (e.g. pregnancy testing to identify female segregation and sell-down options, controlled mating to tighten calving windows, heifer supplementation to reach joining weights earlier, bull selection using estimated breeding values (EBV), and faecal testing to modify supplements) and GLM strategies (e.g. wet season spelling, stocking rate management to avoid overgrazing and property mapping to plan and install fencing and water infrastructure). In 2017, only a small percentage of surveyed graziers believed the changes to animal production and grazing land management strategies improved profitability (39% and 16%, respectively). However, by 2020, most of graziers reported modifying animal production and grazing land management believed the changes would lift gross margins per livestock Adult Equivalent (AE) (92% and 85%, respectively). Actual and intended adoption of business management changes remained low throughout the surveys. The 2017 survey highlighted that 56% of these businesses did not have a written business plan; 72% did not undertake business performance analysis; and 84% were without a financial risk management plan; with the 2019 and 2020 surveys indicating that only 4–7% were making changes to their business management practices.

Legacy products and grazier insights into managing for drought

The observations of graziers who have been successfully managing seasonal climatic variability for decades in some cases, are of interest to their peers and the broader extension and scientific community. GrazingFutures group events, producer mentoring activities and e-learning platforms have resulted in widespread grazier participation in remote and sparsely populated regions of western Queensland. Furthermore, several of these graziers have contributed their insights into managing livestock businesses in a risky climatic, marketing and production environment through the GrazingFutures legacy products. The grazier legacy products showcase grazing business best practice as it relates to herd nutrition, genetics, disease, stocking rates, pasture spelling, infrastructure (fencing and water) development, livestock marketing and drought management-preparedness. GrazingFutures teams partnered with graziers prepared to champion their key principles of effective business and drought management, including:

1. '*Building a financial reserve is important to be less reliant on market forces and seasonal conditions. It gives us the flexibility to sell when we want to, not when we need to. If it gets unusually dry, we are not forced to sell cattle into lower markets, we haven't done that for over 10 years.*' (Colin Burnett, Lara, north-west Queensland) (Queensland Government 2020*a*).
2. '*Overstock your country at your peril. If you are hard on your country and things go bad, you don't have options.*' (Lindsey and Sally Allan, Longford, north-west Queensland) (Queensland Government 2016*a*)
3. '*Avoid the annual panic of running out of grass. Stocking rates should be set so your business can handle a dry year without panicking and emergency destocking. Avoid getting jammed in a corner with no grass by maintaining safe stocking rates in the good years. It took 10 years to really see the value of spelling and reducing numbers on Blanncourt*' (Glen and Cheryl Connolly, Blanncourt, north Queensland) (Queensland Government 2016*b*)
4. '*Hope is not a plan. Grass is key and adjusting stocking rates earlier and making management decisions in this riskier system is essential to ensure a system is in place to cope with prolonged dry periods.* (Russel and Donna Lethbridge, Werrington, north Queensland) (Queensland Government 2019)
5. '*While it is still fresh in your mind do your personal Drought Management Plan with triggers, firm dates and actions*' (Grazier from south-west Queensland) (Queensland Government 2020*b*).

Cost–benefit analysis

A cost–benefit analysis of the GrazingFutures project was conducted by Agtrans Pty Ltd (Agtrans Research 2020), according to the Impact Assessment Guidelines of the Council of Rural Research and Development Corporations (CRRDC, 2014). The AU$6.05 million (present value terms, PVT) DAF investment in the project from 2017–2018 to 2020–2021 was estimated to produce total gross benefits of AU$28.31 million (PVT), a benefit-cost ratio of 4.68 to 1 (using a 5% discount rate over 30 years), an internal rate of return (IRR) of 21.4% and a modified IRR of 7.8%.

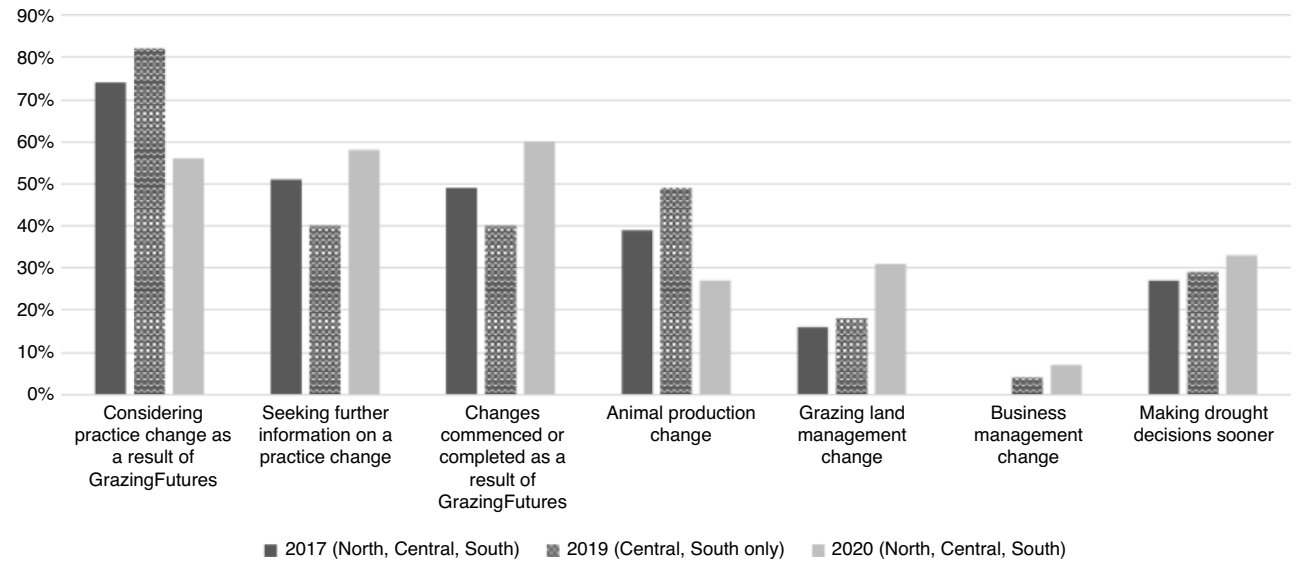

Fig. 3. Independent grazier surveys in 2017, 2019 and 2020 examining changes considered or made in animal production, grazing and business management as a result of GrazingFutures participation.

Discussion

GrazingFutures was implemented to align and enhance GLM, livestock production and people–business extension services in western Queensland through *partnering* with other deliverers, *staff training* to upskill relevant service providers and *legacy products* to record and promote grazier insights and project achievements. To date, many respects the project have been highly successful. Key collaborative partnerships now deliver coordinated industry information and support; several staff have benefitted from dedicated professional skill training and development; and numerous legacy documents from graziers and project staff have been produced, promoted and distributed. Achievement of the broader, less tangible goal of the project, to promote grazier self-reliance and using business resilience as an alternative to crisis management and using drought subsidies, is much harder to measure and quantify. This discussion focuses on delivery of the GrazingFutures project against its objectives, while also recognising any gaps and current or future challenges.

In a comprehensive review of the northern beef industry, Chilcott *et al.* (2020; p. 8) states '*a major impediment to lifting performance is the low rate of adoption of best management practices*.' Funding bodies, peak organisations and public service providers have a renewed focus on low adoption rates. Improved capacity of grazing businesses to manage in drought prone regions is assumed to safeguard (by association) vulnerable landscapes, animals and communities and reduce reliance on government drought subsidies. While grants, government transfers and relief funding (including drought support) are a relatively small proportion (4%) of farm income in the region (ABS 2019*b*), Paxton (2019) showed that the availability of drought subsidies encourages graziers to retain and drought-feed stock instead of selling, with negative flow-on effects to business viability and landscape productivity. Other social, economic and bio-physical complexities (Rolfe *et al.* 2016) at the family and business level also drive long-term overgrazing that is contradictory to restorative land management practices advocated by the research community, extension officers and leading graziers featured in the GrazingFutures legacy products.

While project evaluations indicate producers are changing their GLM practices, a positive shift in rangeland condition and productivity at the landscape level is less evident. 'No rain-no grass-no cattle' is the only successful stocking strategy to manage what is generally a sequence of failed seasons in these extreme environments. Yet livestock commonly remain on denuded rangelands and are drought-fed for extended periods of time. Excluding labour expenses, feeding hay to 500 breeders for 1 month, 3 months or 6 months can cost a grazier AU$63000, AU$189000 and AU$378000, respectively (Queensland Government 2021). For most producers, supplying the daily dry matter feed requirements in the absence of paddock feed, even to a core breeder herd, is difficult to maintain in the long term financially or psychologically. In addition, the sustained overgrazing associated with prolonged drought feeding eliminates desirable forage species and erodes rangeland condition and productivity. The GrazingFutures multi-partner collective acknowledges the widespread overuse of the rangelands and promotes conservative and responsive grazing management as key practices of profitable and resilient livestock operations. Within this overstocking culture, the GrazingFutures staff training and mentoring equips extension officers with the skills and confidence to constructively challenge problematic but widely held beliefs about retaining livestock and overgrazing in dry conditions, while encouraging a shift to sustainable grazing systems.

Poor industry financial performance has also been attributed to low adoption of industry best practice (McGowan *et al.* 2014; Bray *et al.* 2016; Holmes *et al.* 2017*b*). Business practice changes were universally low in GrazingFutures survey results. As is the case with the entrenched land management practices mentioned above, less experienced project staff are generally not yet technically or emotionally equipped and lack the confidence to influence graziers and challenge business management paradigms, emphasising the importance of staff mentoring and professional

development. Appointment of agricultural economists would bolster capacity to improve business literacy and promote adoption of key DCAP drought and business strategies over the remaining phase of the project (Bowen *et al.* 2019*a*, 2019*b*, 2020).

Regional data on industry adoption or benchmarks of extension performance are limited. Bray *et al.* (2016; Climate Clever Beef project) reported adoption of herd and grazing management strategies to cope with seasonal variability and climate change by 5% of grazing businesses, and improved KASA for 19% graziers across the Queensland Gulf, Fitzroy Basin and Mitchell grasslands, and the Northern Territory's Victoria River District and Barkly Tablelands. In these same regions, with a focus on improving grazing resource resilience, Phelps (2014; Climate Savvy Grazing project) reported adoption by 3% of grazing businesses and improved KASA for 13% of grazier participants. GrazingFutures has exceeded these results with internal evaluations showing superior KASA development (26% participants) and industry adoption (10% grazing businesses). As a further measure of success of GrazingFutures, the independent grazier surveys (2017, 2019 and 2020) showed nearly half of respondents had commenced or completed a management change after 4 years. While the Queensland Gulf and Mitchell grasslands are the common regions across all three projects, the duration and resources of GrazingFutures exceeded those of Climate Clever Beef and Climate Savvy Grazing. Other likely contributors to the results of GrazingFutures relate to: (1) multi-agency engagement; (2) WOB project delivery; (3) large scale and ongoing industry presence and service provision at field days, workshops and online settings; (4) one-on-one follow-up support; (5) integration of emerging DCAP research results; (6) flexibility to pivot services and delivery with changing industry needs (e.g. flood and pandemic); and (7) targeted professional development to improve the skills and self-efficacy of graziers and delivery staff.

Pannell and Vanclay (2011) identified that to improve family farm decision making, there is a need to provide a complex social and advisory network. Accordingly, the GrazingFutures project invested in upskilling project staff, enhancing the capacity of project partners and improving collaboration across organisations working in the project. GrazingFutures has involved and resourced local collaborators with the required industry and business skills to assist graziers running remote livestock operations. When these relationships function well, there are the benefits of shared talent, resources and a broader industry reach. Functional multi-agency relationships are dependent on clear project roles and responsibilities. Agency strategic focus and funding arrangements may not always align with that of other project partners. In remote regions, effective collaboration hinges on individual project staff relationships. The importance of upskilling staff in soft skills around personal relationships, problem solving and communications should not be underestimated in implementing collaborative projects. Explicit recognition of the need to develop staff relationship building skills, as well as technical skills, acknowledges the challenges around building collaboration in a multi-agency project. In addition to on-the-job learning and technical mentoring, there has been investment in developing the social capacity of project staff and collaborators across the project region.

The cost–benefit ratio of GrazingFutures is positive, and the true performance of DAF investment is likely underestimated as the calculated benefits were economic and financial in nature. Social and environmental impacts were identified but not valued. In relation to western Queensland graziers and communities, the cost–benefit analysis estimated benefits including increased average annual net farm income, improved environmental outcomes, maintained social licence to operate, increased industry resilience, and increased regional community wellbeing. These benefits show the GrazingFutures delivery model of *partnering*, *staff training*, *service delivery to graziers* and *legacy products* has application beyond building drought resilience and can be effective within any regional and remote grazier and livestock extension program. However, while the impact of GrazingFutures is promising, two key areas for further examination remain. The question of what constitutes a resilient livestock operation (aside from high business equity and innate operator skill) capable of withstanding the inevitable seasonal and other business shocks, requires further investigation. In addition, a concerted campaign promoting the production, profit and animal welfare benefits of balancing livestock numbers with forage availability is necessary to shift the extensive grazing industry into an era of rangeland restoration.

Conclusions

Failure to manage livestock for seasonal variability decreases landscape health, rangeland carrying capacity, animal productivity and long-term enterprise viability. The 6-year Queensland government commitment to the DCAP GrazingFutures project has provided the framework and resources for long-term robust partnerships with a wide range of grazing industry service providers (e.g. NRM groups, production, business, psycho-social and agribusiness) within a constrained RD&E environment of short funding cycles and ongoing staff turnover.

Specifically, GrazingFutures has upskilled extension providers, coordinated group and one-on-one industry engagement, improved the delivery of business and drought management services and reached over 2000 livestock businesses across a significant proportion of western Queensland. Legacy products, including the valuable insights of successful graziers, have been widely produced, promoted and disseminated. Practice change is occurring and an independent assessment found the benefit–cost ratio of the project is approaching five to one.

Nonetheless, GrazingFutures is not without its challenges. Project evaluation surveys have identified low-level farm business management practices among participating producers. In response to this, two agricultural economists will join local GrazingFutures delivery teams to explicitly work with producers on improving business literacy. With 1 year remaining, the GrazingFutures project partnerships are strong, grazier networks are expanding and DCAP research projects continue to provide findings and insights that add value to grazing industry extension services. Project teams are more experienced and capable of challenging problematic but widely accepted industry paradigms, while supporting the adoption of improved grazing and business management practices fundamental to rangeland repair and building drought-ready livestock operations.

Conflicts of interest

Lindsey Perry is a Guest Associate Editor of the *Rangeland Journal* but was blinded from the peer-review process for this paper. The authors declare no other conflicts of interest.

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