

A call for collaboration: linking local and non-local rangeland communities to build resilience

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Abstract. The people who live in Australia's rangelands are vital for maintaining natural systems, agricultural production, infrastructure for tourism and many services and products which benefit the nation. However, the number of people living within many rangeland regions is declining, services are being withdrawn and resilience undermined. Social capital is an important concept within the resilience literature. Bonding social capital is based strong ties within relatively homogenous local groups, bridging social capital is based on ties between more diverse local groups and linking social capital is based on ties between local and external groups. Within the rangelands, there are often strong bonding and bridging social capitals based on internal social and formal connections, but gaps in linking social capital due to weak or imbalanced connections with external groups and organisations. There is evidence that all three social capitals are needed for regional resilience, and the gap in linking is thus a key issue. People who live outside the rangelands can help rebuild this resilience by linking their skills, knowledge and expertise with local groups and communities. Many city-based scientists, policy makers, influencers and other professionals work in and have empathy for the rangelands. By connecting meaningfully with local groups such as Landcare, service clubs, philanthropic groups or Indigenous Rangers, they would find many benefits to their own endeavours through improved policies, knowledge and service delivery. Central-western Queensland is provided as an example where many such mutual benefits and networks already exist, offering pathways for linking local residents with external experts. Current platforms offer opportunities for a greater range of external academic institutions and organisations to engage with locals, with everyone standing to gain.

Keywords: adaptation, agriculture, grazing communities, outback, resilience of rangeland systems, social-ecological systems, tourism.

Received 1 June 2020, accepted 28 September 2020, published online 19 November 2020

Introduction

The people who live in Australia's rangelands are vital to maintaining natural systems and infrastructure, implementing environmental programs, protecting ecosystem function and biodiversity (Woinarski and Lewis 2017), maintaining and developing pastoral and tourism industries, servicing transport operations within supply chains and more (Phelps and Kelly 2019). A large number of scientists and other professionals visit the rangelands to deliver professional services and undertake research. They are as passionate as the locals about wanting a positive future for the rangelands through improved land management, adaptation to climate change and enhanced livelihoods (Foran *et al.* 2019). In this paper, the members of this professional community who visit, but do not permanently reside in the rangelands, are referred to as non-local.

In this commentary paper we call for stronger links between the local and non-local rangeland communities for mutually beneficial outcomes, including building greater resilience for biophysical and socioeconomic rangeland systems. A call for

greater collaboration in rural areas is not new, with examples from overseas (Cofré-Bravo *et al.* 2019) and in Australia (McAllister *et al.* 2008; Dale 2018; Foran *et al.* 2019; Kelly and Phelps 2019). We contribute to this discussion by using central-western Queensland (CWQ) as a case study region and provide examples of effective collaboration and networks which contribute to resilience. As a commentary paper, we do not seek to critically review the literature. Instead, we combine lived experience with a theoretical framework of social capitals to present ideas for other rangeland regions across Australia and internationally. Although more collaboration is called for, many examples of where people are successfully working together are provided and pathways are suggested for how non-local professionals can increasingly connect with locals.

Our premise is that more can be achieved through collaboration that generates benefits such as shared understanding and knowledge, combines resources and skills, and builds mutually beneficial outcomes. In some cases, collaboration may create opportunities that would not otherwise be possible.

The framework of bonding, bridging and linking social capitals (Putnam 1993; Szreter and Woolcock 2004) is used to explore collaboration within local groups, and between local and non-local groups in the CWQ case study region. The next section defines and discusses social capital from a theoretical perspective before outlining existing examples of each.

Bonding, bridging and linking social capital

Social capital refers to ‘features of social organisation, such as trust, norms, and networks that can improve the efficiency of society by facilitating coordinated actions’ (Putnam 1993, p.167). From a networking or connecting perspective, the three main forms of social capital are bonding, bridging and linking, as defined below.

Bonding – where (generally) homogeneous groups of local people strengthen their ties through shared experiences, values and goals (Cofré-Bravo *et al.* 2019; Dressel *et al.* 2020).

Bridging – where local or regionally based people strengthen their ties through shared goals and desired outcomes, but are generally more heterogeneous in their values and experiences—often within structured settings (Cofré-Bravo *et al.* 2019; Dressel *et al.* 2020).

Linking – where local or regionally based people and groups strengthen ties with external individuals and groups, leveraging otherwise limited experience, knowledge, skills and resources, and often connects local citizen initiatives with formal institutions (Cofré-Bravo *et al.* 2019; Igalla *et al.* 2019; Dressel *et al.* 2020).

Bonding social capital corresponds with strong ties between individuals and homogenous groups, such as family and friends (Cofré-Bravo *et al.* 2019). Bridging can also correspond with strong ties through shared regional experience and contexts, whereas Linking social capitals tend to have weaker ties (Cofré-Bravo *et al.* 2019). These weak (or ‘wiry’) ties are important in rangelands, as they can provide efficient increase in resources in times of need (McAllister *et al.* 2011). Collaboration tends to be different between rangelands and coastal regions, partly because of vast distances with low population and huge climate variability over time – spatial and temporal differences impact the social capital.

Bonding and bridging appear to be the most common social capitals within rural communities (for example, Cofré-Bravo *et al.* 2019; in South America; King *et al.* 2019; in New Zealand). Many rangeland communities exhibit strong networks where local people support each other to manage in times of crisis (Rubin 2016). However, there are international examples where strong bonding ties can undermine cooperation with other stakeholders (Yoder and Chowdury 2018), or where bonding and bridging become parochial and insular, making it difficult for non-locals to link with locals (King *et al.* 2019). The same is likely to be true in the Australian rangelands, as strong internal bonding may exclude non-local participants (McAllister *et al.* 2008). Strong bonding social capital potentially can lead locals to reject knowledge and concepts that challenge their social norms (Smith *et al.* 2012).

Local and non-local knowledges develop in different contexts and are often communicated through language specific to each group (Brown 2010). Understanding these different languages and what knowledge is valued is one important step towards effective communication (Brown 2010; Ashwood *et al.*

2014). Both local and non-local communities need to accept and respect differing viewpoints. Non-local professional and scientist knowledge may be based in urbanised social norms as well as theoretical and academic knowledge. It is equally important for non-rangeland community members to understand the need to genuinely listen to local issues, and respect lived experience and solutions. Ashwood and colleagues (2014) propose that success arises through participatory deliberation, active information sharing and equality of knowledge value, which develops greater understanding for application to real-world issues.

There is evidence that community-based initiatives have the best success when all three social capitals are present (O’Brien *et al.* 1998; Halseth and Ryser 2007; Brown *et al.* 2016; Igalla *et al.* 2019; Igalla *et al.* 2020). The absence of linking social capital can lead to greater vulnerability (Straub *et al.* 2020), and by inference maintaining links between local and non-local networks is crucial for local resilience. We suggest that linking is the most important social capital to ensure resilience in CWQ. McAllister and colleagues (2011) agree with the need to develop and sustain efficient ties between local and non-local groups. A first practical step to enhance linking social capital is to introduce non-local professionals and researchers to existing local groups and networks. We draw on this concept from CWQ examples where collaboration through linking has been successful.

The next sections describe the CWQ case study region and outline existing opportunities for collaboration through local groups who have a proactive attitude towards engaging with non-local expertise, people and organisations. Then, examples are provided of mutual benefits of collaboration between local and non-local groups, and how this develops linking capital. The last section outlines potential lessons for other rangeland regions.

The CWQ case study region

Background

CWQ straddles the Tropic of Capricorn, from west of the Great Dividing Range to the Northern Territory and South Australian borders (see fig. 1 in Kelly and Phelps 2019). Compared with other rangeland regions mining occupies a relatively minor area (see Appendix 2 in Foran *et al.* 2019), and there is less land under Indigenous ownership or direct management than the rangelands of Western Australia or South Australia (see fig. 4 and Appendix 2 in Foran *et al.* 2019). Increasing collaboration and social capital in other regions would very likely need to include Indigenous communities as well as mining companies. The examples chosen from CWQ reflect the relatively high proportion of pastoral land, low proportion of Indigenous and mining land and high outmigration compared with other regions.

Vegetation is predominantly unmodified native grasslands, shrublands, open forest and desert ecosystems, which supports cattle and wool sheep production as the dominant land use (Phelps and Kelly 2019). The arid to semiarid climate is summer dominant with highly variable rainfall (Phelps and Kelly 2019).

The population is sparse and declining. The main towns of Barcaldine, Blackall, Birdsville, Boulia, Longreach and Winton each have populations of less than 4000 people (Kelly and Phelps 2019). Droughts have led to lower employment opportunities, and 20% of people migrated out of CWQ between 2007

and 2016 (Kelly and Phelps 2019). This leads to a smaller overall volunteer pool for leadership and governance roles, and less locally available skills, knowledge and ideas (described by Kelly and Phelps 2019 as the downward social cycle). From direct observation, there is an increasing tendency for the same individuals to hold leadership roles across multiple groups. There is evidence that community resilience declines as more groups become over-reliant on key individuals (McAllister *et al.* 2008), a risk of bonding and bridging social capitals being weakened, and a risk of accelerated loss of resilience (e.g. Straub *et al.* 2020). The declining population of CWQ increases the urgency for locals to collaborate with the non-local rangeland community.

Existing social capital: a platform for engagement and further linking opportunities

CWQ has many examples of local groups with strong social, informal and formal ties which underpin bonding social capitals (Appendix 1). Groups and informal settings in local towns create social spaces for friends, family and neighbours to share ideas, socialise and form bonding social capital which develop and reinforce local norms (Szreter and Woolcock 2004; Smith *et al.* 2012).

Bonding social capital in CWQ occurs through either formal local structures such as arts, sports and service clubs or informal settings such as social gatherings of neighbours (e.g. *ad hoc* meetings between individuals in community spaces whilst grocery, rural supplies or hardware shopping). One example of a formal local group intentionally building social capital is the Rotary Club of Longreach. They recognised the need to bring rural neighbours together to support mental wellbeing during the current (2012–present) drought. This resulted in the Club hosting outdoor movies and meals in various locations around the region, with the specific aim of promoting social cohesion and maintaining strong bonding social capital between people who know each other (Phelps and Kelly 2019).

Bridging social capital in CWQ occurs primarily through formal groups, such as the Central West Rural Wellness Network (CWRWN) and the community led Western Queensland Drought Committee (WQDC) (Appendix 1). Both have established bridging social capital by bringing together disparate local people with different experiences, skills and knowledge (Kelly and Phelps 2019). The Remote Area Planning and Development Board (RAPAD) was established to connect the seven local governments within CWQ, bringing people together who may not know each other through shared goals, resources and a united voice (RAPAD 2018) thus developing bridging social capital.

Locally lead groups such as CWRWN, WQDC, RAPAD and others actively reach out to external groups to collaborate, build linkages and develop their programs (Appendix 1). These organisations offer opportunities for other non-local groups to build pathways. For example, the Longreach based Natural Resource Management Organisation, Desert Channels Queensland (DCQ) has worked with local landholders to identify high priority areas for weed eradication, linking this local knowledge with non-local government expertise and funding. This linking social capital has enabled a successful program to eradicate 317 613 ha of the invasive woody weed, prickly acacia, which was not achieved before collaboration being established

(DCQ 2016, 2020). RAPAD collaborates with State and Australian government, accessing expertise and grant to develop programs to help create economic and population growth such as the renewal of the region's sheep and wool industry (RAPAD 2018). These partnerships with government departments have successfully developed linking social capital.

Recent collaboration between the Mithaka Aboriginal Corporation and Griffith University is laying a strong ethical platform for Australian and international scientists to access culturally significant sites (Griffith University 2020). This partnership addresses strategic goals for both organisations. The Mithaka people aim to better understand their country and culture: 'Understanding Mithaka Country, Culture and Mithaka people in the past and into the present is important to the Mithaka People. By integrating non-Indigenous scientific methods with Indigenous approaches and knowledge, we hope to build a thorough understanding of how Mithaka Country received her people and how she carried them in the past and will carry them into the future' (MAC 2017). Griffith University aims to 'establish trust between researchers and create a neutral platform for effective research; implement best practice research using culturally sensitive guidelines and principles; promote innovative research that traverses and benefits western and traditional knowledge' (Griffith University 2017). This partnership will provide strong linking social capital through collaboration and the process of delivering on the strategic goals of both groups.

Many local groups provide less-formal pathways for non-local rangeland community members to engage. For example, the Rotary Club of Longreach welcomes guest speakers on a wide range of topics. Non-local scientists conducting long-term ecological studies into bird migratory patterns (Bino *et al.* 2020), resource web interactions (Moran *et al.* 2019) and small-mammal ecology (Dickman and Robin 2014) would be welcomed as guest speakers to share their experiences, skills and expertise with Rotary, other local community service clubs, Landcare groups, RAPAD and DCQ. Their knowledge would also be welcomed into local school classrooms (both physically and virtually) to inspire local youth through examples of science within their own region, potentially providing educational benefits to future generations (Schweisfurth *et al.* 2018). Even simple, less formal, interactions such as these examples create opportunities to establish linking social capital and build regional resilience.

Collaboration in CWQ has been initiated both by the local organisations (e.g. RAPAD) and by external organisations. One example of collaboration initiated by an external organisation is James Cook University (JCU), which employs staff in CWQ and maintains a telecommuting hub at Longreach as part of their undergraduate medical training. Students live in Longreach to gain experience in rural medicine through the public hospital and a private medical practice. Whilst in Longreach, the students are encouraged to volunteer with local groups to better understand and enjoy life within this rangeland community (Phelps and Kelly 2019). The bonds formed have increased the number of JCU graduates returning to a rural town as a qualified doctor (Woolley and Ray 2019).

The examples of collaboration provided indicate there are multiple opportunities for local CWQ and non-local groups to form linking social capital. CWQ is one rangeland region that

proactively engages with non-local groups in a range of endeavours and there will be examples from other Australian and international locations. Importantly, these CWQ organisations tend to be open to approaches from non-local groups who can help achieve local goals, while achieving goals for the external group.

Not all local groups or non-local professionals may understand the potential shared benefits of collaboration. Some non-local groups have made efforts to collaborate and connect with local communities and groups; others have missed the opportunity to engage with locals. Possible reasons for a lack of collaborating include: (1) non-local organisations and individuals do not understand the wealth of knowledge and expertise grounded in local communities; (2) resource constraints within professional and academic institutions limit exploration (e.g. time, resources) of the potential co-benefits from engaging with local communities and groups; (3) non-local parties lack the knowledge of how to connect into local networks, or may assume that the locals do not wish to engage. The next section explores some of the benefits that have accrued to both locals in the CWQ case study region and to non-local rangeland professionals.

Benefits of collaboration in CWQ

The range of semiarid and arid landscapes, ecosystems, land uses, communities and socioeconomic systems across CWQ has lent itself to research, development, extension and conservation programs from a wide range of organisations over many decades.

Conservation outcomes have been enhanced within CWQ through local engagement. The protection of the once-thought-extinct night parrot (Murphy *et al.* 2017) was enhanced through collaborative management based on listening to local knowledge, experience and values through interviews with local graziers (Garnett *et al.* 2016). Local knowledge has enhanced conservation outcomes for threatened mound spring ecosystems (e.g. Fensham *et al.* 2011), and contributed to a better understanding of tree thickening processes (e.g. Fensham and Fairfax 2005) than biophysical research would have in isolation. In these examples, non-local research and conservation goals were both advanced.

The agriculture industry has benefitted from formal processes which link local knowledge with Queensland and national beef research priorities (NABRC 2020). For example, the CWQ identified issue of on-going drought and high climate variability attracted Meat and Livestock Australia (MLA), Australian and Queensland Government investment into research focussed on climate adaptation strategies (Climate Clever Beef, Bray *et al.* 2016). This has led to investment in research and extension services which links CWQ pastoral knowledge with the Bureau of Meteorology and the United Kingdom Meteorology Office for: (1) improved drought forecasts (through the Forewarned is Forearmed project; BoM 2020); and (2) enhanced climate products (through the Northern Australia Climate Program; NACP 2020). Research is stronger because of local knowledge, and local beef producers have benefitted as well as the cattle industry across northern Australia.

Local employment opportunities can be enhanced through collaboration. The Queensland Government's Drought and Climate Adaptation Program has provided resourcing for additional CWQ based extension staff within the Department of

Agriculture and Fisheries and DCQ through the GrazingFutures project (DAF 2018), and employment of CWQ based climate extension specialists by the University of Southern Queensland through the Northern Australia Climate Program (NACP 2020). Jobs have also been created through conservation and natural resource management initiatives, with Bush Heritage Australia (BHA 2020) and the Indigenous Land and Sea Ranger Program (Queensland Government 2019) employing staff within CWQ. Sustained investment in agriculture and conservation programs help redress the decline in employment opportunities within CWQ (Kelly and Phelps 2019).

There are many opportunities to build on existing, and create new linking social capital between local residents and non-local experts to build resilience in CWQ (e.g. improved professional grant writing for community projects) and enhance research programs (e.g. deeper understanding and insight through shared knowledge). The existing examples of collaboration demonstrate many mutual benefits and can act as inspiration to forge new linkages for the future. For some non-local rangeland scientists, influencers and other professionals, there may be a lack of recognition that local communities wish to engage, or lack of recognition of the mutual benefits that could arise through linking. The locals should not expect to be approached by non-locals, and it is also incumbent on local groups and community leaders to extend a welcoming invitation for the non-local rangeland community to become involved.

How can other rangeland regions benefit from the CWQ experience?

Australia's rangeland regions – and those around the world – require all three of the bonding, bridging and linking social capitals for a resilient future. Bonding and bridging usually develop naturally through existing informal and formal structures. Even though local volunteers and communities may be heavily committed, they tend to be strongly focussed on maintaining these social capitals. In the CWQ case study region, maintaining bonding and bridging social capitals is under increasing pressure from a declining pool of potential volunteers as the overall population declines. It is likely that local and regional groups (Appendix 1) will need to increasingly rely on non-local support for volunteers and resourcing to support solutions through local knowledge. Linking social capital is required to empower, inspire and support local and regional bonding and bridging ties.

For other rangeland regions, recognising the value of strengthening linking social capital is important. International evidence demonstrates that linking social capital is especially important during times of distress (e.g. disasters and drought). Rubin (2016 p402) made the case that 'linking capital provides access to non-redundant and strategically important resources in times of distress' and that it 'enables groups to leverage resources, ideas, and information from formal institutions beyond the community ... external assistance is often an important part of community adaptation'. Whilst Rubin (2016) discusses the case of natural disaster adaptation, we highlight that the concept equally applies to regions like CWQ that are under stress; where declining population and lost economic output during extended drought conditions (Kelly and Phelps 2019) means local resources are already at capacity. In these

cases, non-local resources are necessary to support fully committed local resources in order to build resilience.

Regions need to proactively identify pathways to establish linking social capital, and also recognise there are likely to be challenges. The CWQ examples suggest that existing bonding and bridging social capital can be important foundations for establishing linking social capital. Groups such as RAPAD were initiated to build regional ties and thus enhance bridging social capital. This expanded to becoming proactive in establishing linking social capital through formal partnerships. Equally, there are opportunities to start less-formal arrangements such as guest speakers at local clubs or schools. We suggest there are many rangeland regions with the potential to utilise existing bonding and bridging networks as pathways for collaboration with non-local groups to develop stronger linking social capital.

Establishing, maintaining and linking social capital is likely to include challenges for many regions, which may result from differing communication styles or values. There is also evidence that challenges can arise from imbalanced power structures (Szreter and Woolcock 2004). There is a risk that rangeland regions, distant from large urban population centres and well-resourced organisations, can be overlooked in favour of regions with greater access to decision makers and more resources to champion their causes. CWQ has addressed this risk through: (1) on-going advocacy to non-local influencers; (2) creating pathways to develop linking through formalised structures and groups as well as through the informal networks of community leaders; and (3) ensuring that mutual benefits accrue for both local and non-local organisation, by developing compatible goals for all organisations involved. For example, the WQDC provided evidence of the impact of drought on local town based small business to advocate state and national decision makers for greater resourcing (Kelly and Phelps 2019; Phelps and Kelly 2019). The WQDC established pathways to build linking by including representatives from service clubs, church groups and local government within their governance structure, and informal linkages by utilising the networks of individual members. This has made it easy for non-local philanthropic organisations whose goals are to support people facing hardship during drought to direct resources into CWQ (Phelps and Kelly 2019). At a more personal level, it is important to build mutual trust and respect between local and non-local organisations through effective communication, seeking to share knowledge and understanding values and social norms that have arisen from different experiences. Establishing and maintaining linking social capital is likely to include challenges, but it can be achieved by local groups through a proactive approach to establish trust, good communication and mutual benefits.

There is a need to find mutual benefits to encourage collaboration between local and non-local rangeland communities. Locals can identify local issues and will have often discussed possible solutions and explored innovations over an extended period. However, locals can benefit from external perspectives and fresh ideas, and additional resources for implementation. Much can be achieved through concerted voluntary effort within existing or emerging networks and ties – but a more strategic and coordinated approach is necessary to address chronic issues. Declining resident populations, reduced livelihoods, increased vulnerability to drought and disasters and reduced capacity to

manage land for productivity, sustainability and conservation outcomes requires the linked efforts of local and non-local rangeland communities.

Shared issues and solutions can contribute to mutually beneficial outcomes. Ten contemporary themes have been identified across Australia's rangelands (Table 1, based on Foran *et al.* 2019; Nielsen *et al.* 2020). We suggest that linking social capital is the key gap for seven of these themes: 'natural capital'; 'governance'; 'research and development'; 'the social licence to operate'; 'technology opportunities and threats'; 'capital leakage'; and 'human capacity and capability' (Table 1). These seven themes either: (1) represent an externality where it is essential to link local solutions to the non-local source (e.g. the social licence to operate originates from external markets and societal values); or (2) a situation where local resources alone are inadequate to address the theme (e.g. with a declining total population in CWQ, strengthening 'human capacity and capability' requires both linking to non-local volunteers for additional capacity and training locals in areas such as governance to improve capability).

The lived experience from CWQ provides examples for other rangeland regions to adapt to their own context and seek opportunities to strengthen linking social capital to build resilience.

The call to collaborate: foster linking social capital across local and non-local rangeland communities

Linking social capital is crucial to building resilient communities and regions, generating shared knowledge and successful application of science to real-world problems. As the lived experience of CWQ and the literature (e.g. Fensham *et al.* 2011; Bray *et al.* 2016; Garnett *et al.* 2016; NACP 2020) indicate, the opportunity exists to develop linking social capital through engagement with existing local groups to benefit academic and conservation outcomes. A key challenge is in facilitating the first steps for engagement, and linking different knowledge systems to build a place of lasting trust and dialogue. Although a strategic and coordinated approach to developing linking social capital is needed to build resilience in the biophysical and socioeconomic systems of the rangelands, the shared passion of local and non-local rangeland communities provides a practical starting point.

Most rangeland regions have ample opportunities for non-local experts to engage with local and regional groups to build linking social capital, to share in rewarding discussion and undertake joint action. Shared knowledge will grow when non-local expertise is engaged with local knowledge and experience. Longer-term benefits will accrue by engaging with youth, for example if world-leading academics take the time to speak in classrooms this could inspire a new generation of scientists and leaders.

Many benefits can accrue for the non-local rangeland community if they engage with locals. We invite every rangeland professional to reach out to one of the many groups embedded in the region. Equally, we invite local groups and individuals to seek out the non-local rangeland experts working within their region and invite them to link more closely to the local community. Although CWQ was used as the example for this commentary paper, we have no doubt that the potential for collaboration, mutual benefits and building resilience is similar across all of Australia's rangelands and in other parts of the world.

Table 1. Key Australian rangeland themes (adapted from Foran *et al.* 2019; Nielsen *et al.* 2020) and a commentary on gaps in bonding, bridging and linking social capitals within CWQ which limit resilience

Theme/social capital	Bonding	Bridging	Linking
	Characterised by strong ties shared between local people based on common experiences, values and goals, bonding can be assumed to develop naturally	Characterised by strong ties between local organisations, groups and people or within a broader region with common goals, bridging can be assumed to need proactive participation to develop	Characterised by ties between regions, states or internationally with mutually beneficial reasons to connect, linking can be assumed to need effort and structured approaches, or strong leadership and interpersonal relationships, to develop
Livelihood: supporting local communities	Minor gap. There is localised support between businesses for skills, knowledge and community events	Key gap. Small business coordination and peer support is weak within the region e.g. no coordinated approach to 'buy local' campaigns and limited opportunities for peer mentoring to improve business resilience Specific needs include: recognition within CWQ of the need for small business peer mentoring, skills and knowledge sharing, creating a culture of support and leading to proposed regional solutions which can then explore opportunities for linking of resources and expertise	Secondary gap. Linking could support efforts but the desire for coordination needs to come from within the region
Natural capital	Minor gap. DCQ approach to weed control involves groups of neighbours; wild-dog exclusion fencing provides opportunities for neighbour collaboration; land management solutions often discussed in community settings	Secondary gap. There is limited sharing of land management approaches and knowledge at the regional level	Key gap. Natural capital changes on grazing lands are largely driven by external factors e.g. meat and wool prices failing to include the cost of natural capital; lack of linking between local knowledge and non-local funding and programs. Whilst there are examples from RAPAD and DCQ of strong linking capital, consistent and sustained linking is needed Specific needs include: sustained effort into sustainable grazing systems which balance economic and environmental pressures; discovery research into flora and fauna population dynamics and distribution; creating opportunities to embed regional economic growth with conservation of natural place based assets
Climate: variability and change	Minor gap. Contention remains over strength of anthropomorphic contribution to climate change with local opinion divided	Key gap. Insufficient collaboration within the region and between groups to establish an effective coordinated adaptation response to climate: variability and change Specific needs include: strong regional leadership which addresses scepticism of scientific evidence based in nuanced discussion that meets local values and observations of variability and weather extremes	Secondary gap. Information and programs to address climate change are established but sustained linkages are needed through external programs such as DCAP
Traditional knowledge (including Younger and more Indigenous)	Key gap. Potentially, the ability to progress traditional knowledge is limited by weak collaboration at local levels Specific needs include: supportive processes which facilitate bonding to develop	Minor gap. There may be less need for sharing of knowledge between different groups of traditional owners, however a coordinated approach in seeking recognition is essential	Secondary gap. Linking could support efforts but the desire for coordination needs to come from strong and united local traditional owner groups, as demonstrated by the Mithaka-Griffith University partnership

(Continued)

Table 1. (Continued)

Theme/social capital	Bonding	Bridging	Linking
Governance	Minor gap. There is strong sharing of knowledge, skills and volunteers between local groups which reinforces good governance	Secondary gap. There is strong bridging of local government through RAPAD; however there is limited sharing of knowledge, skills and volunteers between community groups across the region; more formalised bridging may find solutions to the declining population and smaller volunteer pool	Key gap. Strong governance exists at local bonding (e.g. well administered local clubs) and regional bridging levels (e.g. RAPAD) with sustained linking needed to empower and resource these local and regional arrangements; there is an increasing need for the volunteer pool to include non-locals as the CWQ population declines Specific needs include: structures which support local and non-local collaboration within groups e.g. contra arrangements that support board positions such as secretarial services, effective linking of non-local volunteers with local groups
Research and development	Minor gap. There is generally strong sharing of knowledge, skills, ideas and solutions between neighbours at local levels	Secondary gap. There are many innovations by individuals which are shared informally, but not always beyond local networks	Key gap. There is research and development across CWQ in a range of topics, especially the beef industry (e.g. through the WQRBC) which should be expanded across industries, but it does not link with local people or groups in a way that can build resilience Specific needs include: climate change adaptation, weather extreme preparedness, enterprise and land use economic analysis, sustainable natural capital management, place based regional opportunities, the role of traditional knowledge in modern society, socioeconomic systems and policy support mechanisms for declining long-term local and shorter-term 'nomadic' workforce
The social licence to operate	Secondary gap. The impacts of the lack of a broad social licence are greatest at the local level, but solutions will arise through linking	Minor gap. Regional bridging of groups can support linking social capital between external and local groups	Key gap. The social licence to operate is driven by external factors, linking social capital is essential to understand values, ideologies and address global issues at local levels Specific needs include: identifying good industry practices for promotion to consumers, finding alternatives to unacceptable practices; identifying globally acceptable industry drivers e.g. eco-tourism which conservation of natural capital, grazing practices which reduce carbon miles to market, livestock enterprises which preserves endangered domesticated species
Technology opportunities and threats	Minor gap. Strong networks amongst peers usually spread technology ideas quickly, and social norms tend to guide local implementation	Secondary gap. There may be a need to increase the sharing of ideas to implement technology between regional groups, especially to identify solutions to potential threats	Key gap. Most technology opportunities and threats arise from external sources e.g. for town based business, the ability to remain competitive with global on-line shopping competition relies on modern internet connectivity Specific needs include: creating job opportunities by encouraging ag-tech companies to be based within the region, maximising opportunities to use technology such as broadband internet to attract tele-commuting jobs

(Continued)

Table 1. (Continued)

Theme/social capital	Bonding	Bridging	Linking
Capital leakage	Minor gap. Individuals and local groups are relatively powerless to prevent capital leakage, as their influence is on local markets e.g. initiatives that create incentives for local people to shop locally will have limited impact compared with investment through linking	Secondary gap. Bridging is needed as a platform to establish linking, and in aspects such as providing advocacy for the region, attracting business investment and enhancing local professionalism in conducting business	Key gap. Capital leakage from CWQ is through poor value adding within the region e.g. unprocessed wool sold from the region, with jobs and economic stimulation occurring elsewhere; linking social capital is required to create opportunities between the points of production and value adding closer Specific needs include: finding ways to create more regional value adding to increase retention of wealth and enhance power equality with larger population centres
Human capacity and capability	Secondary gap. Local communities, groups and leaders have an essential role in supporting non-locals to feel welcome, identify shared goals and mutual benefits, to increase their desire to spend time in the region	Minor gap. Regional groups such as RAPAD can provide structured pathways for non-locals to link with locals, but the overall structures and attitude of local people is probably more important to form long-term ties	Key gap. With a declining population, the future of human capacity and capability for CWQ will necessarily be through linking. Specific needs include: finding ways for 'modern nomadism' to thrive and enrich communities e.g. socio-economic and policy structures systems which support tourism and hospitality employees to work the peak winter season in CWQ and the peak summer season in southern regions

Conflicts of interest

The authors declare no conflicts of interest.

Acknowledgements

The authors thank the organisers of the 20th Biennial Conference 2019 of the Australian Rangeland Society for their invitation to deliver the John Milne Rangeland Journal Lecture. A key element of the conference presentation 'What makes a rangeland community adaptive and resilient?' formed the basis of this paper. The authors acknowledge the on-going support of the Journal for submissions in the field of socioeconomics within the rangelands. The main author's conference attendance was supported by the Queensland Government through the Department of Agriculture and Fisheries. This Special Issue was funded by the Australian Centre for International Agricultural Research (ACIAR).

References

- Ashwood, L., Harden, N., Bell, M. M., and Bland, W. (2014). Linked and situated: grounded knowledge. *Rural Sociology* **79**, 427–452. doi:10.1111/ruso.12042
- BHA (Bush Heritage Australia) (2020). Bush Heritage Australia; Places we Protect; Queensland. Available at <https://www.bushheritage.org.au/places-we-protect/queensland> (accessed 8 May 2020).
- Bino, G., Brandis, K., Kingsford, R. T., and Porter, J. (2020). Waterbird synchrony across Australia's highly variable dryland rivers – risks and opportunities for conservation. *Biological Conservation* **243**, 108497. doi:10.1016/j.biocon.2020.108497
- BoM (Bureau of Meteorology) (2020). Forewarned is forearmed (FWFA). Available at <http://www.bom.gov.au/research/projects/FWFA/> (accessed 23 August 2020).
- Bray, S., Walsh, D., Phelps, D., Rolfe, J., Broad, K., Whish, G., and Quirk, M. (2016). Climate clever beef: options to improve business performance and reduce greenhouse gas emissions in northern Australia. *The Rangeland Journal* **38**, 207–218. doi:10.1071/RJ15124
- Brown, V. A. (2010). Multiple knowledges, multiple languages: are the limits of my language the limits of my world? *Knowledge Management for Development Journal* **6**, 120–131. doi:10.1080/19474199.2010.532148
- Brown, W. A., Andersson, F. O., and Jo, S. (2016). Dimensions of capacity in nonprofit human service organizations. *Voluntas* **27**, 2889–2912. doi:10.1007/s11266-015-9633-8
- Cofré-Bravo, G., Klerkx, L., and Engler, A. (2019). Combinations of bonding, bridging, and linking social capital for farm innovation: how farmers configure different support networks. *Journal of Rural Studies* **69**, 53–64. doi:10.1016/j.jrurstud.2019.04.004
- DAF (Department of Agriculture and Fisheries) (2018). About DCAP. Available at <https://www.daf.qld.gov.au/business-priorities/environment/drought/dcap/about-dcap> (accessed 8 March 2018).
- Dale, A. P. (2018). From conflict to collaboration: can better governance systems facilitate the sustainable development of the northern pastoral industry, communities and landscapes? *The Rangeland Journal* **40**, 331–340. doi:10.1071/RJ18010
- DCQ (Desert Channels Queensland) (2016). Listening, researching, innovating, implementing: three years of unprecedented success. DCQ Prickly Acacia Eradication Program – 2013–2016. Available at <https://dcq.org.au/wp-content/uploads/2016/11/Three-Years-of-Unprecedented-Success.pdf> (accessed 23 August 2020).
- DCQ (Desert Channels Queensland) (2020). Premier weed control. Available at <https://dcq.org.au/premier-weed-control/> (accessed 18 April 2020).
- Dickman, C. R., and Robin, L. (2014). Putting science in its place: the role of Sandringham Station in fostering arid zone science in Australia. *Historical Records of Australian Science* **25**, 186–201. doi:10.1071/HR14014
- Dressel, S., Johansson, M., Ericsson, G., and Sandström, C. (2020). Perceived adaptive capacity within a multi-level governance setting: the role of bonding, bridging, and linking social capital. *Environmental Science & Policy* **104**, 88–97. doi:10.1016/j.envsci.2019.11.011
- Fensham, R. J., and Fairfax, R. J. (2005). Preliminary assessment of gidgee (*Acacia cambagei*) woodland thickening in the Longreach district,

- Queensland. *The Rangeland Journal* **27**, 159–168. doi:10.1071/RJ05013
- Fensham, R. J., Silcock, J. L., Kerezszy, A., and Ponder, W. (2011). Four desert waters: setting arid zone wetland conservation priorities through understanding patterns of endemism. *Biological Conservation* **144**, 2459–2467. doi:10.1016/j.biocon.2011.06.024
- Foran, B., Stafford Smith, M., Burnside, D., Andrew, M., Blesing, D., Forrest, K., and Taylor, J. (2019). Australian rangeland futures: time now for systemic responses to interconnected challenges. *The Rangeland Journal* **41**, 271–292. doi:10.1071/RJ18105
- Garnett, S. T., Kleinschmidt, M., Jackson, M. V., Zander, K. K., and Murphy, S. A. (2016). Social landscape of the night parrot in western Queensland, Australia. *Pacific Conservation Biology* **22**, 360–366. doi:10.1071/PC16014
- Griffith University (2017). Griffith helps uncover archaeological past in Mithaka Country. Available at <https://news.griffith.edu.au/2017/07/24/griffith-helps-uncover-archaeological-past-in-mithaka-country/> (accessed 30 August 2020).
- Griffith University (2020). Research grants. Australian Research Centre for Human Evolution. Archaeology and Natural History of the Mithaka Country (LP170100789). Available at <https://www.griffith.edu.au/environmental-futures-research-institute/research-centre-human-evolution/our-centre/research-grants> (accessed 30 August 2020).
- Halseth, G., and Ryser, L. M. (2007). The deployment of partnerships by the voluntary sector to address service needs in rural and small town Canada. *Voluntas* **18**, 241–265. doi:10.1007/s11266-007-9042-8
- Igalla, M., Edelenbos, J., and van Meerkerk, I. (2019). Literature review of citizen initiatives, their main characteristics, outcomes, and factors. *Voluntas* **30**, 1176–1194. doi:10.1007/s11266-019-00129-0
- Igalla, M., Edelenbos, J., and van Meerkerk, I. (2020). What explains the performance of community-based initiatives? Testing the impact of leadership, social capital, organizational capacity, and government support. *Public Management Review* **22**, 602–632. doi:10.1080/14719037.2019.1604796
- Kelly, D., and Phelps, D. G. (2019). Looking beyond the D.U.S.T. – building resilient rangeland communities. *The Rangeland Journal* **41**, 233–250. doi:10.1071/RJ18047
- King, B., Fielke, S., Bayne, K., Klerkx, L., and Nettle, R. (2019). Navigating shades of social capital and trust to leverage opportunities for rural innovation. *Journal of Rural Studies* **68**, 123–134. doi:10.1016/j.jrurstud.2019.02.003
- MAC (Mithaka Aboriginal Corporation) (2017). Ngali wanhi ‘we search together’. Mithaka research framework. Launched July 2017. Available at <https://mithaka.com.au/strategic-plan/research/> (accessed 1 September 2020).
- McAllister, R. R. J., Cheers, B., Darbas, T., Davies, J., Richards, C., Robinson, C. J., Ashley, M., Fernando, D., and Maru, Y. T. (2008). Social networks in arid Australia: a review of concepts and evidence. *The Rangeland Journal* **30**, 167–176. doi:10.1071/RJ07040
- McAllister, R. R. J., Holcombe, S., Davies, J., Cleary, J., Boylea, A., Tremblay, P., Stafford Smith, D. M., Rockstroh, D., LaFlamme, M., Young, M., and Rola-Rubzena, M. F. (2011). Desert networks: a conceptual model for the impact of scarce, variable and patchy resources. *Journal of Arid Environments* **75**, 164–173. doi:10.1016/j.jaridenv.2010.09.009
- Moran, N. P., Wong, B. B. M., and Thompson, R. M. (2019). Communities at the extreme: aquatic food webs in desert landscapes. *Ecology and Evolution* **9**, 11464–11475. doi:10.1002/ece3.5648
- Murphy, S. A., Silcock, J., Murphy, R. K., Reid, J., and Austin, J. J. (2017). Movements and habitat use of the night parrot *Pezoporus occidentalis* in south-western Queensland. *Austral Ecology* **42**, 858–868. doi:10.1111/aec.12508
- NABRC (North Australia Beef Research Council) (2020). Regional Beef Research Committees. Available at <https://www.nabrc.com.au/regional-committees/> (accessed 16 May 2020).
- NACP (Northern Australia Climate Program) (2020). About NACP. Available at <https://www.nacp.org.au/about> (accessed 23 August 2020).
- Nielsen, U., Stafford-Smith, M., Metternicht, G. I., Ash, A., Baumber, A., Boer, M. M., Booth, S., Burnside, D., Churchill, A. C., El Hassan, M., Friedel, M. H., Godde, C. M., Kelly, D., Kelly, M., Leys, J. F., McDonald, S. E., Maru, Y. T., Phelps, D. G., Ridges, M., Simpson, G., Traill, B., Walker, B., Waters, C. M., and Whyte, A. W. (2020). Challenges, solutions and research priorities for sustainable rangelands. *The Rangeland Journal* **42**. doi:10.1071/RJ20059
- O’Brien, D. J., Raedeke, A., and Hassinger, E. W. (1998). The social networks of leaders in more and less viable communities six years later: a research note. *Rural Sociology* **63**, 109–127. doi:10.1111/j.1549-0831.1998.tb00667.x
- Phelps, D., and Kelly, D. M. (2019). Building drought resilient rangelands: lessons from central-western Queensland. *The Rangeland Journal* **41**, 251–270. doi:10.1071/RJ18052
- Putnam, R. D. (1993). ‘Making democracy work: civic traditions in modern Italy.’ (Princeton University Press: Princeton, NJ, USA.)
- Queensland Government (2019). Indigenous Land and Sea Ranger Program – ranger locations; Lake Eyre Basin. Available at <https://apps.des.qld.gov.au/land-sea-rangers/?ranger=lake-eyre-basin> (accessed 10 May 2020).
- RAPAD (Remote Area Planning and Development Board) (2018). RAPAD strategic plan 2018–2020. Proactively shaping and creating a prosperous future for the RAPAD region of outback Queensland. Available at <https://www.rapad.com.au/assets/Uploads/RAPAD-Strategic-Plan2018-20-print.pdf> (accessed 19 April 2020).
- Rubin, O. (2016). The political dimension of linking social capital, current analytical practices and the case for recalibration. *Theory and Society* **45**, 429–449. doi:10.1007/s11186-016-9277-8
- Schweisfurth, M., Davies, L., Pe Symaco, L., and Valiente, O. (2018). Higher education, bridging capital, and developmental leadership in the Philippines: learning to be a crossover reformer. *International Journal of Educational Development* **59**, 1–8. doi:10.1016/j.ijedudev.2017.09.001
- Smith, J. W., Anderson, D. H., and Moore, R. L. (2012). Social capital, place meanings, and perceived resilience to climate change. *Rural Sociology* **77**, 380–407. doi:10.1111/j.1549-0831.2012.00082.x
- Straub, A. M., Gray, B. J., Ritchie, L. A., and Gill, D. A. (2020). Cultivating disaster resilience in rural Oklahoma: community disenfranchisement and relational aspects of social capital. *Journal of Rural Studies* **73**, 105–113. doi:10.1016/j.jrurstud.2019.12.010
- Szreter, S., and Woolcock, M. (2004). Health by association? Social capital, social theory, and the political economy of public health. *International Journal of Epidemiology* **33**, 650–667. doi:10.1093/ije/dyh013
- Woinarski, J., and Lewis, D. (2017). ‘My country, our outback voices from the land on hope and change in Australia’s heartland.’ (The Pew Charitable Trusts: Washington, DC.) Available at <https://www.pewtrusts.org/en/research-and-analysis/reports/2017/06/my-country-our-outback-voices-from-australias-remote-heartland> (accessed 20 April 2020).
- Woolley, T., and Ray, R. A. (2019). Effectiveness of regional medical schools in attracting and retaining students for early-career practice in the local area: The James Cook University experience. *The Australian Journal of Rural Health* **27**, 125–131. doi:10.1111/ajr.12498
- Yoder, L., and Chowdury, R. R. (2018). Tracing social capital: how stakeholder group interactions shape agricultural water quality restoration in the Florida Everglades. *Land Use Policy* **77**, 354–361. doi:10.1016/j.landusepol.2018.05.038

Appendix 1. Example central-western Queensland (CWQ) based community groups, organisations and governing groups^A, their areas of operation and the key social capitals they foster

Group	Area of operation	Main (and secondary) social capital	Short description and key citation
Australian Government (Centrelink, National Drought and North Queensland Flood Response and Recovery Agency)	Service CWQ, primarily located in Longreach or Barcardine	Linking (bridging)	Australian Government agencies within CWQ primarily link national services to local communities and people, often with staff who act as local 'champions' to advocate for continued resourcing of services within their agencies; staff often volunteer within local organisations
Queensland Government Departments (e.g. Agriculture and Fisheries, Premier and Cabinet, Environment and Science, Transport and Main Roads, Health, Police Service)	Service CWQ, primarily located in Longreach or Barcardine	Linking (bridging)	Queensland Government agencies within CWQ primarily link state-based services to local communities and people, often with staff who act as local 'champions' to advocate for continued resourcing of services within their agencies; staff often volunteer within local organisations
Remote Area Planning and Development Board (RAPAD)	CWQ	Linking (bridging)	Initiated by the seven CWQ Local Governments to collectively promote and advocate for the region and more effectively coordinate services and resourcing
RAPAD Employment Services Queensland	CWQ and south-west Queensland	Linking (bridging)	Initiated within CWQ to link employment services with Australian Government programs
Rural Financial Counselling Service North Queensland	CWQ within a national setting	Linking (bridging)	Administered by RAPAD to deliver State and Commonwealth funded confidential, free and impartial rural financial counselling services to primary producers, fishers and small rural businesses experiencing financial difficulties
Desert Channels Queensland (DCQ)	CWQ	Linking (bridging)	Founded through a Commonwealth initiative in 2002 to establish community groups to deliver regionally based natural resource management (NRM), DCQ operates from Longreach and links Commonwealth and Queensland Government NRM programs with regional priorities.
Western Queensland Drought Committee (WQDC)	CWQ plus south and north-west	Linking (bridging)	Initiated by the CWQ community in 2015 to seek and direct external philanthropic and public funds into local drought relief
Bush Heritage Australia	Conservation lands within CWQ (and beyond)	Linking	Link national programs with external, and often international, funding and deliver on-ground conservation and biodiversity outcomes for key ecosystems e.g. mound springs
Indigenous Land and Sea Rangers	CWQ within a national program	Linking	Indigenous Land and Sea rangers deliver negotiated work plans that reflect Traditional Owner, local community, and Queensland Government priorities and provides employment opportunities for indigenous people within environmental, cultural heritage and community engagement activities
Royal Flying Doctor Service (RFDS)	CWQ within a national setting	Linking (bridging)	A national not for profit organisation with a base in Longreach, it provides emergency medical airlifts, regular health clinics and mental health services to areas that don't have access including CWQ; it was initiated in north-west Queensland in 1927
Western Queensland Regional Beef Research Committee (WQRBC)	CWQ and south-west Queensland	Linking (bridging)	One of eleven regional committees chaired by beef producers with broad industry representation which play a key role in developing priorities for Meat and Livestock Australia's annual call for grass-fed beef research, development and adoption projects
Central West Rural Wellness Network (CWRWN)	CWQ	Bridging (linking)	Initiated within CWQ as a forum for front-line service agencies to share and discuss well-being initiatives and address on-ground needs, especially for the prevention of suicide during drought, and to advocate for effective resourcing

(Continued)

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Group	Area of operation	Main (and secondary) social capital	Short description and key citation
Chambers of Commerce (e.g. Longreach Regional Enterprise)	Within local towns	Bridging (linking)	Typically, not for profit groups which represent business interests in their local community, the only example in CWQ is Longreach Regional Enterprise which formed in 2016 to promote and advance trade, commerce and industry in the Longreach region
Red Ridge Interior Queensland Ltd	CWQ and south-west Queensland	Bridging (linking)	Initiated within CWQ to contribute to healthy and resilient communities, with linkages to external philanthropic and public funds as a member of a Queensland network of regional arts service providers
Longreach Multipurpose group	Longreach and district	Bridging (linking)	Initiated within CWQ as an umbrella organisation over all sport, youth and recreational groups in Longreach, provide a collective voice and access to external grants
Longreach Retired Services League Sub Branch	CWQ	Bonding (linking)	Founded locally in 1918, it is one of the earliest sub branches in Queensland, it runs a Services and Memorial Club and supports veterans, serving members and the wider community
Churches (e.g. Catholic, Anglican, Uniting, Salvation Army)	Within local towns, linked through formal structures	Bonding (linking)	Christian churches continue to play a strong bonding role within CWQ and are linked through formal structures to national and international networks
Service Clubs (e.g. Meals on Wheels, Rotary, Lions, Lioness, Zonta, Country Womens Association, Masonic Lodge)	Varies according to clubs, but generally district	Bonding (linking)	These clubs are generally branches of regional, state, national and often international organisations, each club was initiated and is run locally; they generally have a district or regional focus e.g. The Lions Club of Longreach also service towns 200–300 km away.
Arts and cultural groups	Within local towns	Bonding	Local groups with formal or informal structures which offer meeting places and bonding through shared interests in art and craft
Sporting clubs (e.g. local squash, tennis, touch football, golf, rifle)	Within local towns	Bonding	Local sporting clubs bring people together for social and competitive sport and provide opportunities to learn about effective governance and administration
Sporting competitions (e.g. Rugby League, cricket)	Locally based clubs within CWQ based competitions	Bonding (bridging)	Sporting competitions provide opportunities to travel to other towns and regions to compete and socialise more broadly and provide opportunities to learn about effective governance and administration
Local Government	Designated government areas within CWQ	Bonding (linking)	Local Government within CWQ run many community events within towns to maintain social cohesion, provide the fundamental needs of towns (e.g. potable water and sewerage) and deliver state-based programs
Indigenous corporations (e.g. Mithaka Aboriginal Corporation, Pitta Pitta Aboriginal Corporation, Waluwarra Georgina Sulieman Rivers People Aboriginal Corporation, Central Queensland Indigenous Development, Central West Aboriginal Corporation, Winton District Aboriginal Corporation)	Traditional lands within CWQ	Bonding (linking)	Indigenous corporations within CWQ are varied in their structure and function ranging from linking University based research to preserve traditional knowledge (e.g. a partnership between the Mithaka people and Griffith University) through to delivering government services to local indigenous people (e.g. the Central West Aboriginal Corporation)

^AIncluding examples of government agencies with offices and services permanently based in CWQ.