

# Building human capacity, capability and future leaders for Australia's rangelands

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**Abstract.** Maintaining a skilled, knowledgeable and adaptable workforce in Australian rangeland enterprises and research, development and extension/adoption (RD&E/A) organisations is a varied and challenging task, compounded by trends of sustained losses of human capacity through senior retirements and short-term appointments over the last decade. Concerns for how to fill these gaps while gaining the skills and knowledge needed for a successful career and leadership roles were raised by students and young professionals in the World Cafe session and throughout Early Career workshops and activities at the 2019 Biennial Conference of the Australian Rangeland Society (ARS). This paper responds to these expressed information needs through drawing on literature, experiences shared by session participants, and existing ARS members currently working in the rangelands in diverse roles to provide insights into two main areas: (i) skills and knowledge for personal development and future success in the rangelands across three broad classes of occupation/careers (i.e. advisors, researchers, and producers), and (ii) skills and knowledge that will be expected of future leaders in the rangelands. We outline a variety of options for professional development in the early stage(s) of a career working on aspects of sustainable production systems and pathways to leadership throughout a career in the rangelands. We note the apparent lack of formal rangeland-specific education in Australia, and suggest that this is a major impediment to efforts to build skills and knowledge to ensure the viability of the livelihoods and the integrity of our rangelands. Finally, we believe that the ARS has the potential to play a more central role in inspiring interest and passion for the rangelands, in providing current information on (i) range science and management-relevant education and training opportunities in Australia and internationally, and (ii) leadership development and training opportunities; and in facilitating and supporting mentoring to develop and retain human capacity for a resilient future.

**Keywords:** education, extension, knowledge and skill development, leadership and rangelands, management, research, training.

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## Introduction

Human capacity in Australia's rangeland enterprises and research, development and extension/adoption (RD&E/A) organisations is currently low, spread very thinly, and is vulnerable with an ageing workforce generally declining in number (Roxburgh and Pratley 2015; Massie 2017; Pratley 2017; Foran *et al.* 2019). Although these conditions could create interesting career opportunities for people passionate about the rangelands who understand what it takes to live and work in rural and remote regions, there are serious constraints to realising this and a strategic approach to workforce building and renewal is required.

Interest and enthusiasm for working in the rangelands is usually aroused in one of three ways: (i) being raised in the rangelands, (ii) a pre/early career and formative experience (e.g. holiday or field trip), or (iii) interacting with a passionate teacher or individual from/in the rangelands (Lock *et al.* 2012;

Stephens *et al.* 2013). Further exposure can highlight career opportunities and prospects, and can lead to development of a passion for the rangelands. Most people who come to work in RD&E/A or enterprise management in the rangelands have either a plant/animal production or natural resource management (NRM) background, with Vocational Education and Training (VET), bachelor or postgraduate level qualifications (Thompson and Mohr-Bell 2017). Many soon realise that the rangelands are defined by geography, not by sector, and that range management involves both art (i.e. experience-based intuition) and science. It is an interdisciplinary field that requires the integration of soil, plant, animal, wildlife and environmental sciences, hydrology, economics, sociology and policy (Abbott *et al.* 2012). They soon recognise that collaboration is needed to deal with 'wicked' problems, and that broader, more specific and better integrated knowledge and skills are needed to be

effective in working in or managing the complex systems we know simply as ‘rangelands’.

The challenges, the lifestyle, the people, the sense of community and the landscapes are what attracts people to work in the rangelands (Puxty and Rodney 2008). Although previous experience in the rangelands during training significantly increases the likelihood of staff retention (Haslam-McKenzie 2011), some staff don’t stay for long. They leave for a variety of reasons including poor job security, low remuneration, professional obstructions such as a lack of support services, limited career options, lack of succession planning, limited or inappropriate professional development, inflexible working conditions, and poor relationships and communication with their leaders (Wagstaff 2004; CIE and RSG 2008, Puxty and Rodney 2008; Stephens *et al.* 2013; Locher Human Resources 2014; Korff 2017; Thompson and Mohr-Bell 2017). Others leave due to personal constraints such as reduced opportunities to form intimate relationships (Alston and Kent 2004), lack of opportunities for partners and children (e.g. employment, childcare/education) (Roufeil and Battye 2008) and break down in family relationships (McKenzie 1999). The loss of people causes significant economic, social and environmental costs, and frustration for government and the private and public sectors (Haslam-McKenzie 2011), and reduces a community’s adaptive capacity (Phelps and Kelly 2019), yet the ongoing presence of skilled and educated individuals in rangeland communities is critical to address challenges, adapt to change and achieve resilience. Those who stay will become more versatile and ‘rounded’ professionals, and often find that they have opportunities not available in bigger centres, fast-tracking their early career. In order to build a future cohort of resilient operatives and leaders in rangeland enterprises, agencies and communities, it is essential that a diverse range of practitioners are recruited, are provided reasonably secure longer-term job prospects, offered the right training to improve their skills and effectiveness, and provided sufficient support to encourage them to continue to live in and look after the rangelands (Wagstaff 2004; Foran *et al.* 2019). There are some generational differences in communication skills, technical abilities and ability to adapt to change (Cucina *et al.* 2018), but these should be seen as positives, not negatives, in the pool of skills, knowledge and perspectives, providing sources of fresh ideas and innovation for current and emerging issues.

The availability and longevity of relevant training and support are a looming challenge with corporate memory and experience being lost with high rates of retirements in many industry, extension and research organisations. This has the potential to prompt a parallel loss of expertise and historical context as well as the potential for duplication of earlier work. These issues and the failure to achieve substantial adoption of decades of research and development (R&D) (Shepherd 2014; Chilcott *et al.* 2020) need to be addressed to maximise the value of past investments in R&D and avoid costly duplication of effort.

### **Information needs raised by students and early-mid career professionals**

The importance of the above issues led to the ‘Building Capacity and Future Leaders’ World Café session and an Early Career Practitioner Workshop and related activities during the 2019 Biennial Conference of the Australian Rangeland Society

(ARS). Participation in these events was dominated by students and early career professionals with varied long-term career interests. In the three cycles of the Café session, junior participants were invited to raise issues/concerns, to which established professionals and other participants were invited to respond by offering strategies to address the issues, identifying relevant initiatives and/or suggesting sources of relevant information. The Early Career Workshop began with several presenters providing an overview of their career(s) and highlighting key skills that were central to their success. This was followed by a period of interactive questions and one-on-one discussions.

Major issues and questions raised in these events, now the focus of this paper, are related to:

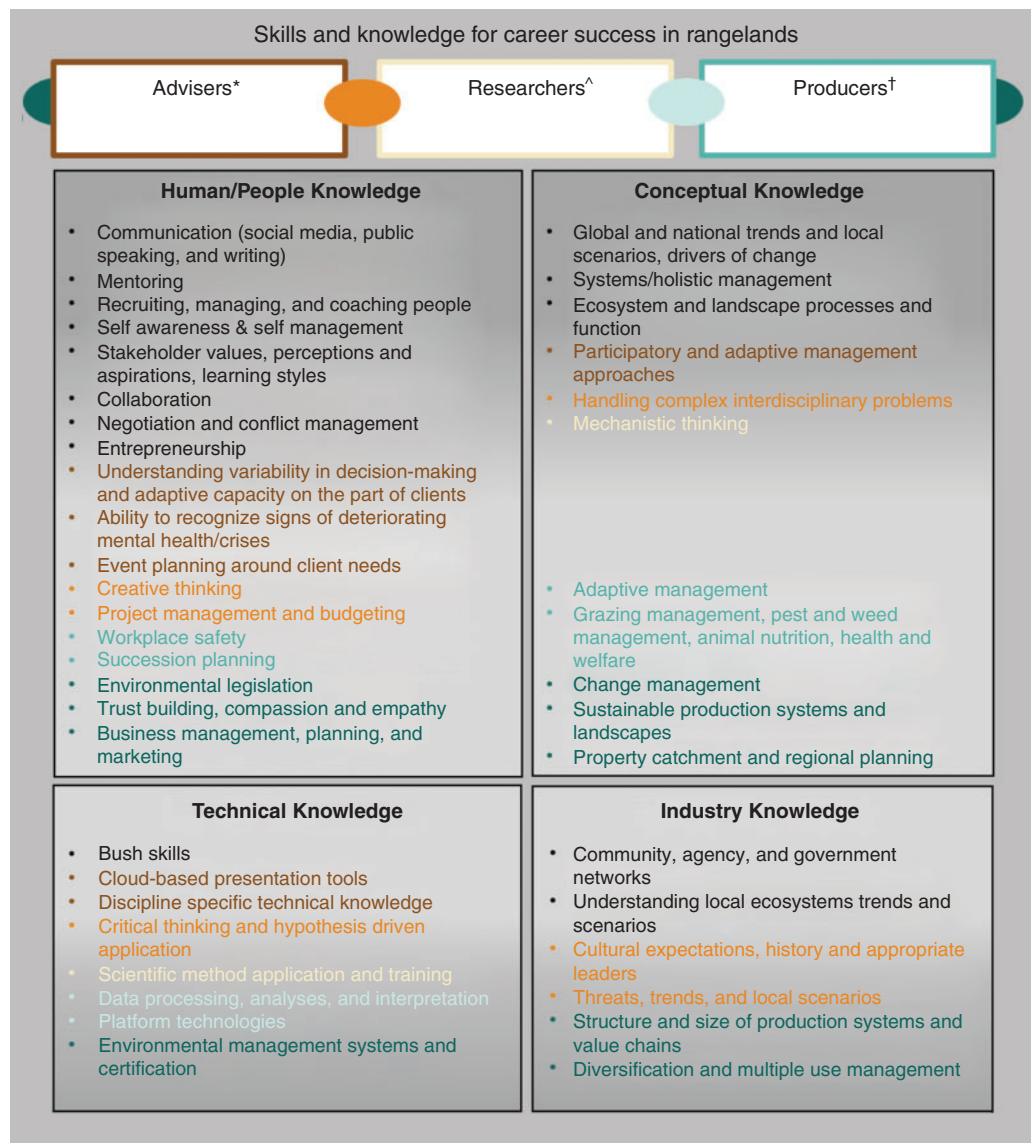
- how to learn in a new work environment;
- key skills and knowledge needed in major roles/occupations;
- identifying and addressing skills gaps;
- opportunities for learning about rangeland science and management in our universities;
- career pathways and timelines;
- career development, training and mentors, and
- leadership qualities and development options.

In view of the scope and nature of the issues raised, this review is restricted to how these issues and questions relate to those working in, or seeking to work in, RD&E/A and management of sustainable livestock production systems in the rangelands. However, we acknowledge that with ongoing consolidation of smaller enterprises, pastoralism may play a less important role in rangeland economies, and a more holistic and diversified view of rangeland science and management that includes tourism, mining and conservation (Roxburgh and Pratley 2015), mosaic agriculture and indigenous economic development will be required in the future. A growing interest in natural capital, ecosystem service payments, greenhouse gas emissions and carbon markets will also need to be considered in addressing the knowledge and skills needs of increasingly diversified enterprises.

The issues raised and the limited scope of this article have led us to focus on three broad classes of occupation involved in the management of the majority of the rangelands, *viz.* (i) advisors/extension officers, (ii) researchers/scientists, and (iii) producers/pastoralists/graziers/managers – all dealing with animal production and/or natural resource management (NRM) related issues. People may also be managing rangelands for conservation, cultural values and indigenous economic development. Many of the skills and much of the knowledge listed below would also apply in these situations, but additional skills and knowledge will be required. We acknowledge that there are other respected sources of advice (e.g. livestock, merchandise and property agents; agribusiness consultants, accountants, rural lenders, traditional owners), and that the three occupations focussed on are increasingly blurring with the growth of participatory action research (Coppock 2016), co-design of research (Galvin *et al.* 2016) and collaborative science (Bestelmeyer *et al.* 2019; Williams and Bellgard 2019).

### **Addressing the expressed needs**

We have consolidated the issues and concerns raised in the 2019 conference activities, and addressed them by sourcing relevant hard and soft literature (i.e. opinions and engaging narratives of



**Fig. 1.** Common and unique skills associated with the three main career paths in the rangelands. Skills in black are common among all three occupations, while secondary colours are common between the two comprising primary colours (orange skills are key for both advisers and researchers, for example). Sources for skills listed are provided in conjunction with each path: Allomes (2016)<sup>†</sup>; Braddick (2004)<sup>\*\*†</sup>; Brosnan (2014)<sup>†</sup>; Campbell (2010)<sup>^</sup>; Davies (1999)<sup>^</sup>; Foran *et al.* (2019)<sup>^</sup>; GCA (2016)<sup>\*\*†</sup>; Gritzso *et al.* (2017)<sup>^</sup>; Heath (2017)<sup>\*\*^†</sup>; Hund *et al.* (2018)<sup>^</sup>; Kelly (2002)<sup>\*\*^</sup>; Korff (2017)<sup>†</sup>; Locher Human Resources (2014)<sup>\*\*†</sup>; Marshall and Smajgl (2013)<sup>\*\*^</sup>; McRobert (2015)<sup>†</sup>; Massie (2017)<sup>\*\*†</sup>; Mealor and Frost (2012)<sup>\*\*^</sup>; Moore and Rudd (2004)<sup>\*\*^</sup>; Ritchie (1999)<sup>†</sup>; Stephens *et al.* (2013)<sup>\*\*^</sup>; Strachan (2001)<sup>†</sup>; Taylor (2003<sup>\*\*†</sup>, 2004)<sup>\*\*†</sup>; Thomas and Day (2010)<sup>\*\*^</sup>; Thompson and Mohr-Bell (2017)<sup>\*\*^</sup>; Welch and Kossler (2010)<sup>†</sup>; White (2004)<sup>†</sup>; Whyte and Ingram (2006)<sup>†</sup>; Willis (2017)<sup>\*\*^</sup>; Williams and Bellgard (2019)<sup>\*\*^</sup>.

the lived experience of people with a strong interest in rural leadership and development), and incorporating the shared experience(s) of: (i) the participants in the Café session and (ii) presenters from the Early Career Workshop and the Student and Young Professionals session at the 2017 ARS conference, along with the authors' personal insights. In doing so, we aim to (i) outline and highlight key skills and knowledge supporting future success within the rangelands, (ii) identify traits that are common across these occupations while also highlighting skills that

are unique to a particular specialty into the future (Fig. 1), and (iii) highlight skills associated with transitioning to serving as a leader within the rangeland community. Elsewhere we have identified some specific options for developing leadership skills currently available in Australia (ARS 2020a).

Increasingly, advisers and researchers are coming from non-traditional rangeland or agricultural backgrounds (Taylor 2004; Korff 2017), and, by providing a central point of career-related information for students and early and mid-career RD&E/A

professionals, we also aim to meet a long standing need for such integrated information to guide career development (Thompson and Mohr-Bell 2017). Providing such guidance in a centralised location and format, and updating it as available resources change, could be an excellent future strategy to link the Australian Rangeland Society (ARS) to early career practitioners in particular, something that ARS members have recognised as vital for the long-term sustainability of the organisation.

### **Knowledge, attitudes, skills and aspirations for a successful career**

Skills and knowledge are two key components that drive a person's competency and effectiveness. We define 'knowledge' as the information and concepts that can be acquired through observation, reading and study, and can be shared. 'Skills' refers to the ability to apply knowledge effectively in a particular context and to adapt previous understanding to changing conditions. This ability comes from training, experience and/or practice. In contrast, 'attitude' is a positive or negative feeling about something that is constructed from currently available information, can fluctuate or persist for many years, is difficult to change, and which influences how one approaches a challenge (Bennett 1975). These components and personal attributes drive an individual's capacity to perform and enable success in one's career. 'Success' is a personal construct that involves achievement of an aspiration, planned goals and/or a vision. In the rangelands, this may include, for example, having a positive impact in managing a pest or weed, making a difference in a rangeland community, managing a profitable and sustainable enterprise or just being proud of one's accomplishments and legacy. Success is driven by the right attitude and outlook, and training in the appropriate knowledge and skills (Hichens 2018), and perceptions of competency reflect the integration of knowledge, skills and attitude. However, it should be recognised that, while the development of an individual's knowledge, attitudes, skills and aspirations (KASA) are essential stepping stones to successful practice change, they do not guarantee it. Practice change, and ultimately successful RD&E/A outcomes, only occurs when people apply their 'KASA' to working and living (Bennett 1975); and a range of other factors (e.g. economic, social/cultural, personal) can influence whether this is achieved or not.

A large and diverse group of rangeland stakeholders identified 'commitment and passion for the rangelands' as the most important personal attribute for future success (Taylor 2002), and this was highlighted again by the presenters in the Students and Young Professionals session at the 2017 biennial conference (ARS 2017).

There are four key domains in the array of knowledge and skills required for perceptions of competence and personal success in key occupations in the rangelands today; *viz.* people, conceptual, technical and industry knowledge and skills. Specific skills and knowledge required for success in the rangelands are listed in Fig. 1 for three occupations – advisors/extension officers, researchers/scientists and producers/pastoralists/graziers/managers. General considerations across all careers include the importance of flexibility throughout a career and being open to changes in focus and experiences, life-long learning and continued professional development. Importantly, staying focussed on personal goals that guide one through

career stages and experiences, can be the key to limiting over-commitments and setting boundaries on one's personal expectations and those of others.

Looking ahead, the skills and knowledge needed to meet emerging and potential challenges (place or interest-based) in the rangelands are likely to be very broad and quite different from those required to meet today's challenges. It follows that, across all three occupations, active learning experiences and a 'can do' attitude will be important for professional growth. The following knowledge and skills will be increasingly important by 2030, and will be sought after by employers: digital literacy, financial literacy, creativity, originality and initiative, technical design and programming, complex problem solving, communication, teamwork, leadership and social influence, emotional intelligence, and systems analysis and evaluation (FYA 2017). In dealing with stressful situations (e.g. drought, floods, periods of transition between property owners, mental health issues), conflict management skills will be important (Kam *et al.* 2020). Capacity for dealing with information (e.g. satellite imagery, big data) and communication technology (e.g. smart technology, artificial intelligence), drones, robotics with sensor technologies, energy generation and storage (Pratley 2017), and more diversified enterprises (Lyons 2017) will also influence the future skills and knowledge needs of all three occupations.

### *Advisors/extension officers*

This role has typically been an intermediary, an agent for information transfer between researchers and producers and vice versa. Most public-sector advisors focus on either livestock production or natural resource management, although this distinction is blurring, and there is a small but growing presence of advisors who specialise in other relevant disciplines, such as business and people management. The rangelands are still largely dependent on advisors from the public sector (Roxburgh and Pratley 2015; Gatenby 2018), in contrast to more intensive, broadacre farming regions. The low densities of grazing enterprises in the rangelands and the small scale of most private advisor businesses makes the viability of these more challenging, and limits their capacity to take on a graduate or trainee in Australia (Gatenby 2018). However, with public sector extension in decline in many rangeland regions (Gatenby 2018), and recent initiatives such as Meat & Livestock Australia's (MLA) Future Livestock Consulting Internship (MLA 2020a), it seems inevitable that private advisors in the rangelands will become more common.

A common pathway for an advisor position has been a bachelor's degree, several years of industry experience and mentoring by an experienced operative, followed by postgraduate study (e.g. graduate certificate, masters degree) (Stephens *et al.* 2013). The industry experience may involve a technical role in research and/or secondment to a private sector consultant to build business skills.

Advisors are effectively change agents, using communication skills and processes to facilitate learning and change within the businesses and communities with which they work (Fulton *et al.* 2003). Over the past 10–15 years, this role has changed from providing direction and advice to one of collaboration, encouraging and supporting change, and nurturing innovation (Mealor and Frost 2012; Massie 2017; Reichstein 2017; Coutts *et al.* 2017, 2019). Indeed, it has long been recognised that

interpersonal skills and ability to liaise effectively are often more important in this role than technical skills (O'Shea and Holmes 1988; Kelly 2002; Stephens *et al.* 2013), although technical skills are clearly a critical element of an advisor's credibility. Advisors should endeavour to understand their customers/clients – what motivates, drives and impedes practice change – and recognise that a producer's personality type, perception of risk(s), income needs and dynastic and cultural expectations are influential factors in adoption of technology (Braddick 2004; Reichstein 2017; Hamilton *et al.* 2019). A high level of trust is usually required before producers will accept information and commit to training or adoption of new practices (O'Shea and Holmes 1988; McRobert 2015). Trust takes time and patience to develop, and can be easily lost. Advisors should also recognise a possible need to deal with a producer's lack of trust and confidence in young graduates, their suspicion of government (Kelly 2002), personal prejudices (Allomes 2016), and the response that 'my property is different'. This can be managed by ensuring that the value of a practice is evident (McRobert 2015), openly engaging with the producers' experience, and establishing relevance to an immediate problem or need (Mealor and Frost 2012), integrating solutions into the business and personal circumstances (McRobert 2015), and applying persuasion skills (Shepherd 2014).

The big challenges and issues in the livestock industry have been drought, managing climate variability and climate change, managing costs and increasing production, and compliance with increasing and changeable environmental regulations (McRobert 2015). Pest and weed management, soil erosion management, fire management, habitat restoration and climate variability have been the big issues in NRM (Thomas and Day 2010). Five years ago, the most important areas of unmet producer's skill development/training needs were, in declining order of importance, pasture management and grazing management, market requirements, feeding and animal nutrition, animal health and husbandry (McRobert 2015). Business information and skills are now a priority for producers (Gatenby 2018, Phelps 2019; Phelps and Kelly 2019), and 'social licence to operate' will be an increasingly important issue. It is important that young advisors understand the diversity of learning preferences, and recognise that half (54%) of all producers are not focussed on formal learning and are unlikely to pay for training or professional advice. Cattle-only producers are the least willing and sheep only producers the most willing to pay for advice, while goat producers had a higher level of participation in training than sheep only, cattle-only or combined cattle and sheep producers (McRobert 2015). The suite of knowledge required by advisors/extension officers to serve today's industry and community needs is shown in Fig. 1.

Looking ahead, there is a need to invest in the skills of advisors and target larger and younger producers to address the poor adoption of R&D (McRobert 2015). New (<10 years' experience) advisors have expressed a high level of interest in training to develop technical knowledge, mentoring, working with peers and producers, and a need for information on environmental sustainability and whole farm systems (Sherriff and King 2019). Facilitating connections between younger advisers and researchers will be important in keeping them up to date with the latest R&D, developing skills, deepening

understanding of research processes and building professional connections and networks (Sherriff and King 2019). The integration of psychological variables (i.e. intrinsic motivations, social identity, recognition; Pickering *et al.* 2018) in the design and implementation of projects and skills in engaging non-traditional stakeholders, co-design and co-production of research (Galvin *et al.* 2016), coaching (Sobotta *et al.* 2016), adaptive management (Marshall 2015; Wilmer *et al.* 2018), evaluating change, anticipating producers' needs, and having accessible products and services that are pertinent to the current situation and flexible in their delivery, will be increasingly important.

#### *Researchers/scientists*

This role is about discovery, innovation and developing procedures in a variety of specialised areas to, for example, increase livestock productivity, manage lands/landscapes sustainably, conserve biodiversity and control pests and diseases. These days, the designation of 'scientist' usually requires doctoral qualifications (Pratley and Roxburgh 2013), and an active program of scientific research and publishing.

Of the three broad types of research (i.e. basic, strategic, applied), strategic and applied research are mostly what occurs in the rangelands. Applied research is increasingly the provenance of advisors today, and many postgraduate students with experience in research may opt to follow that path. A strategic researcher will often be part of a larger team, including extension officers and applied researchers, addressing a multi-disciplinary or transdisciplinary problem. Industry experience is widely valued in this role. A strong basic science and applied science background, and training in research skills and methodology (i.e. data collection and analysis) are essential (Stephens *et al.* 2013). Other important knowledge and skills that may be less common in many classic coursework programs leading to a research degree include writing (i.e. grant applications and publications), managing intellectual property (Dimond and Sarre 2011), and communication, initiative and project/budget management (Giles *et al.* 2009).

The traditional pathway for researchers is an undergraduate degree, honours, a doctorate, post-doctorate appointments and then term appointments as a researcher. However, without ties to industry and application throughout the degree process this pathway can produce graduates who lack industry context/understanding and real world experience, and who will probably require close supervision and mentoring (Stephens *et al.* 2013). An alternative, and historically very successful pathway, involves 3–10 years of work experience before undertaking a PhD. This produces graduates who are perceived to retain industry links, understand the social and cultural process of producer's decision making and undertake the most successful projects (Stephens *et al.* 2013), but at a significant personal cost. Industry sponsored programs (e.g. MLA's Postgraduate Scholarship Program in Australia) may alleviate some of the difficulties in transitioning between academic and industry needs and expectations, and may enable a more rapid advancement through management and other professional training (Giles *et al.* 2009). While Australian university funding of national on-farm R&D has grown significantly over the past 10 years (Millist *et al.* 2017), there is a concern that few Australian

universities now have the specialists, with technical expertise and experience of rangeland areas, for teaching and supervision of postgraduates and budding researchers (Roxburgh and Pratley 2015). However, this appears to be more of a problem with graduates from NRM than livestock-focussed programs. Furthermore, the pressure on academics to publish in high impact factor journals is leading to fewer research articles being readily accessible to advisors and industry leaders (Tennant *et al.* 2016; Welch 2016). This weakens the connections between research and management in the rangelands.

Researchers should recognise that there is some cynicism about research in the wider community and a lack of faith in research processes (Campbell 2010). As with advisors, this can be managed by open communication and community engagement (Campbell 2010), openly valuing experience, and using an immediate problem or need for context (Mealor and Frost 2012). Poor uptake of R&D is a major concern (Chilcott *et al.* 2020), and various strategies that engage a diversity of stakeholders in co-design, co-production and co-dissemination of results (Galvin *et al.* 2016; Bestelmeyer *et al.* 2019) are being adopted to address complex problems through transdisciplinary research. Identification of relevant stakeholders and their effective engagement are critical to success in these endeavours. There is also a greater focus on 'usable science' (Brunson *et al.* 2016; Fuhlendorf and Brown 2016; Maczko *et al.* 2016) as related approaches for managing the co-production of knowledge, positive research outcomes and meeting the needs of a diversity of decision makers.

The disciplines and specialisations integral to rangeland research and management have been: soil science, pasture science, ecology, animal husbandry, genetics, nutrition, livestock production, animal behaviour, agricultural economics, modelling and sociology (Stephens *et al.* 2013; Roxburgh and Pratley 2015). More recently, systems approaches (SAMRC 2016), climate science and remote sensing, greenhouse gas emissions and carbon sequestration have been added to that list. However, the suite of knowledge required by researchers today is much broader (Fig. 1), encompassing a range of specialties including science communication and outreach, and science-policy advocacy.

Looking ahead, over the next decade consumer sentiments will increasingly drive investments in RD&E/A, and the major goals for food and agriculture research will include improving the efficiency of food and agriculture systems, increasing the sustainability of agriculture and increasing the resilience of agricultural systems to adapt to rapid changes and extreme conditions (NAoS 2019). Key research challenges will include reducing soil loss and degradation, optimising water use, precision livestock monitoring and management systems, and early detection and prevention of plant and animal pests and diseases (NAoS 2019). These will result in larger, longer-term projects that engage a broader audience and involve transdisciplinary research and mixed experimental approaches (Fuhlendorf and Brown 2016), encompass sensing technologies, data science and informatics, and understanding of animal, soil and plant microbiomes. It is important to recognise that, by engaging producers and other relevant stakeholders with different perspectives on a broad issue/problem, it is unlikely that there will be one simple, best answer (Fuhlendorf and Brown 2016). Indeed, being open

to the possibility of being wrong and willing to consider and being respectful of other stakeholders' ideas are the hallmarks of 'humble science' (Porensky 2020). Researchers will need to develop a greater capacity for systems thinking to assess unintended consequences (Lyons 2017), and the impact of their work on the bottom line of business (Korff 2017), in the context of the failure to adopt past R&D. This will either require a certain level of skill and knowledge in pastoral business economics and extension/adoption (Gatenby 2018), or the ability to work collaboratively with specialists in these areas. Organisations employing researchers and the bodies funding and commissioning research will increasingly require an analysis of the economic, social and environmental benefits as part of research proposals and project evaluations (Pannell 1999; MLA 2020b).

#### *Producers/pastoralists/graziers/managers*

This role is perhaps the most complex, requiring knowledge and skills in 'on property' functions such as managing land, environmental and cultural sites, infrastructure, livestock, people and finances and 'off property' issues such as marketing of produce, relationships with regulators and interest groups (e.g. environmental, indigenous, animal welfare) and policy/legislation. A key part of this role is the understanding of how these integrate and impact at various scales (Ritchie 1999; White 2004), and how to work effectively with highly technical service providers (Korff 2017). The latter will be increasingly important as producers become more 'organisers' than 'doers' (Heath 2017), and this is where soft skills and attitude will influence perceptions of competence. Many of the knowledge and skills needs of producers have been highlighted earlier in the paper as required of advisors and researchers. Overall, the skills needs of a producer today are akin to that of a Chief Executive Officer (CEO) (Heath 2017) (Fig. 1).

Traditionally, producers/managers in the Australian rangelands have developed their knowledge and skills 'on the job', guided by older, more experienced family members, neighbours and/or work colleagues. Until relatively recently, these tended to focus on livestock and land management knowledge and skills, and were often drawn from a relatively narrow perspective. In the last two decades, post-school qualifications gained through vocational education and training rather than university have been highly significant (House of Representatives Standing Committee on Agriculture, Fisheries and Forestry 2006) and producer participation in a range of short courses has increased. Education influences both capacity and willingness to innovate, and adoption on farm has been related to educational attainment of producers (Roxburgh and Pratley 2015). Few producers currently have a relevant degree; however, if the trend in other agricultural industries (e.g. cotton, Kahl 2017) is any indication, it seems inevitable that, in time, a degree or at least an advanced diploma will increasingly be required for a producer/manager role. This will probably happen faster in the corporate sector than in family operations.

Some producers are fearful of learning, resistant to new ideas and uncomfortable with the pace of change (Taylor 2003; Harrington 2018), and this can negatively influence young people's perceptions of (particularly) older producers. Producers can manage these perceptions by openness, listening, a positive attitude (White 2004), and actively engaging in

adaptive management and collaborative science approaches (Marshall 2015; Williams and Bellgard 2019). Better management of risk and uncertainty, shared learning opportunities and experimentation, psychological and financial buffers, and facilitating an interest in change will enhance adaptive management capacity (Marshall and Smajgl 2013). This will be important to remain sustainable, meet growing external demands and expectations, and be a resilient grazing-based business.

Looking ahead, it will be increasingly important to have the capacity to assess the viability of e-commerce options (Heath 2017), assess new technologies (e.g. smart monitoring), their risks and impact on business, and objectively build a business case to justify them (Korff 2017). Also important will be a producer's responsibility to teach the next generation early (Tiller 2017), to plan for succession and become a more competitive and sustainable employer (Payne 2018). However, consumer sentiments, demand for branded, quality assured products and 'social license to operate' considerations (e.g. animal welfare) will place increasing pressure on all producers to meet community expectations for landscape condition and environmentally assured products (Coleman 2018; Foran *et al.* 2019), and actually be able to demonstrate their realised environmental credentials.

### Identifying and filling skills and knowledge gaps

There are a variety of ways for an individual to identify and assess whether they have the skills needed to fully carry out the tasks associated with their chosen career. There are formal assessments through performance evaluations (e.g. 360° feedback, AIM 2020), personality tests, skills assessments or informal discussions with mentors to shed light on strengths/weaknesses and skill development needs. It is also useful to invite constructive feedback from peers – those who think like the person does and those who do not. These insights are valuable for reflections on possible career paths, and will also influence the option(s) and perhaps the sequence for skill development, as well as the nature of the complementary and diverse perspectives, skills and experience one might seek to have around them in building or leading a well-functioning team in the future.

#### *Formal, higher education opportunities*

Vocational education and training (VET) and higher (i.e. university) education are widely seen by industry and RD&E/A agencies as important to foster innovation, generate and apply relevant knowledge, ensure compliance with regulations and retain staff (Taylor 2004). Furthermore, the availability of higher education is important in rural, regional and remote Australia for attracting and retaining people, improving access to tertiary education and addressing fundamental inequalities between rural/remote and urban areas (Haslam-McKenzie 2007; Drummond *et al.* 2011). Indeed, Douglas (2019) has recommended establishing an inland/outback university as one of four strategies to increase the visibility of rural and remote issues, increase locally relevant research, create value and improve regional wellbeing. However, without significant and continued investment by government, industry and philanthropists (Gatenby 2018), this, and proposals for livestock or dryland

centres of excellence are unlikely to progress or be sustainable. The concept of a 'virtual hub' might be a more feasible option.

What is required in range-specific training is an integration of the production, economic, environmental and social aspects of rangeland use and management, a focus on the practical aspects (AgTrans Research 1998), and meeting the educational and training needs and learning preferences of the people in the rangelands (Lonie and Andrews 2009). This suggests a need for a curriculum that looks very different from that currently offered in most agriculture and environmental science programs in Australia today.

Despite the long recognised need for formal university education in range science and management in Australia (Roberts 1977; AgTrans Research 1998; Roxburgh and Pratley 2015), and the long history of, and international reputation in, research and innovations that have had national and global impact (Metternicht and Stafford Smith 2020), a web search using the terms 'range/rangeland', 'arid/semiarid', 'pastoral', 'dryland' and 'outback' revealed no programs currently operating in Australian universities with a focus on the rangelands and/or the knowledge and skills required in rangeland-specific further education. This confirmed the disappearance of undergraduate and postgraduate coursework programs in range science and management some time ago (e.g. University of New South Wales's Bachelor of Science in Wool and Pastoral Sciences, 1967–1985; University of Queensland's Graduate Certificate/Graduate Diploma/Masters in Rangeland Management, 2002–2012), and the view expressed by Café participants that, apart from research, 'our universities are providing little or no rangeland-specific training'.

The web search also revealed that there are currently only a few university courses in Australia that apparently have some focus on rangelands or aspects of range science and management (in alphabetical order by provider).

#### Undergraduate:

- Pasture and Rangeland Management (AGRI 3005) – Curtin University
- Life in Arid Lands (BIOS3161) – University of New South Wales
- Outback Ecological Field Studies (BIOL3016) – University of Queensland
- Crop and Pasture Agronomy (AGRO4003) – University of Sydney

#### Postgraduate:

- Advanced Outback Ecology (ECOL6821) – University of Queensland
- Arid Land Environments (ENVT5035) – University of South Australia

Unfortunately, the majority of these courses are currently only offered in 'internal' mode which limits access by people living in rural and remote Australia. While university marketing typically highlights research-weighted ratings (e.g. Times Higher Education/QS World University Rankings), student experience ratings (i.e. educational experience, learner engagement, learning resources, skills development, student support and teaching quality) are probably more important for rangeland-based students. Further, in the important area of student experiences, few of the above providers rate in the top 20% of the field of agriculture and environmental studies (GEG 2019).

There may well be other offerings in Australia with some focus on the rangelands in various agriculture and environmental science programs, and a listing and a relevance rating of these on the ARS website would greatly assist people with an interest in furthering their education in range science and management in Australia. We also note that these limited and narrow offerings (above) are in crowded and often restricted programs/curricula (i.e. livestock or NRM focussed), and, from the brief overviews that are accessible, are not apparently associated with courses that might also develop the integration of disciplines, systems thinking and soft skills (e.g. critical thinking, communication, teamwork, conflict management) that are so important to problem solving, community engagement and personal effectiveness in rangelands. Heath (2017) notes that the traditional generalist agriculture and resource management training in Australia is not sufficient to meet future workforce needs and will not provide the high level management skills required by producers and service providers. Furthermore, the decline in extension activity and extension training in higher education institutions (Ampt *et al.* 2015; Thompson and Mohr-Bell 2017) is a major impediment to addressing the need to improve uptake and adoption of R&D (Foran *et al.* 2019; Chilcott *et al.* 2020). So, individuals seeking training in extension and some of the more generalised skill development areas will probably need to identify coursework aimed at promoting active learning within non-rangeland-specific courses (Williams and Bellgard 2019). Greater flexibility in taking units/courses from other institutions could assist in meeting these needs, but a readily accessible listing of relevant offerings and cross-institutional collaboration would be required to facilitate this.

Despite the importance of range-specific knowledge to the effectiveness and professional development of rangeland professionals, the lack of Australian university offerings is unlikely to change anytime soon, as these institutions have generally been slow to respond to the changes in graduate attributes/skill sets required of graduates (White 2004; Korff 2017). This is a serious constraint to building capacity in the rangelands, and a missed opportunity to meet a need for overseas aid through range management education in emerging economies, most of whom possess significant areas of rangeland (Campbell 2020; Metternicht and Stafford Smith 2020), but the real demand for rangeland-focussed courses or a program today is unclear, and needs to be addressed.

In the meantime, finding the 'right' Australian university for professional development is important. In choosing an institution one should consider the following: (i) the 'real world' experience of the person actually delivering the course(s), (ii) any reviews/student experience ratings of the course(s) (especially engagement and student support), and (iii) course delivery modes as proximity to one's operating base will influence time and cost considerations. Looking beyond Australia, the USA-based, Society for Range Management (SRM 2020) and the Rangelands West websites (Rangelands West 2020) provide a listing of north American-based universities providing qualifications, accredited programs and courses specifically in range science and management. Many of the US institutions are Land Grant Universities, specifically established to support the educational advancement of agricultural and industrial studies, are in regions of relevance to Australian

biomes (e.g. grasslands, shrublands), and their offerings can be accessed externally (Rangelands West 2020). The US has the population and economies of scale lacking in Australia, and long histories of range science and management teaching and research. Several ARS members have undertaken higher and research degrees through some of these institutions, and could be approached for advice and recommendations through the ARS member network. Several US-based institutions provide 'road maps' and degree plans for various range-based occupations, and some have 'study abroad' options which bring groups of students to Australia to undertake intensive courses. These options provide opportunities to be exposed to international perspectives on range science and management issues, and to broaden networks.

#### *Short courses/webinars/workshops/conferences*

Short courses, webinars, etc. can be an effective means of upskilling, are more accessible in remote Australia and may be better than longer term training programs in some cases. Industry (e.g. Meat & Livestock Australia (MLA), Australian Wool Innovation (AWI), pastoral corporations), consultants (e.g. Resource Consulting Services (RCS), Holistic Resource Management (HRM)), government agencies and regional NRM groups regularly run short courses and webinars on current and emerging issues in response to demand, and membership of these groups can keep interested people informed of opportunities to broaden their skills and networks. Involvement in these activities can also assist in, for example, making connections with the local community, industry representatives, and fast track local acceptance. National conferences can provide exposure to a wider network, new perspectives on regionally or nationally important issues, and inspiration. For example, the ARS holds biennial conferences, mostly in rangeland centres, which attract advisors, researchers and producers from across Australia as well as some international researchers and academics. Organisations like the Northern Australia Beef Research Committee (NABRC) run a Northern Beef Research Update Conference every three years that attracts advisors, researchers and producers; the Australian-Pacific Extension Network (APEN) holds biennial conferences that attract advisors, researchers and academics; and AgriFutures Australia's evokeAG meetings attract entrepreneurs and future young leaders and facilitates exchange of information and in use of technology in the food and agriculture sectors. Participating in workshops that are organised by some universities and aimed at addressing a key skill development need for a particular focus group of practitioners, further benefits the relationship between researchers and those who may apply the findings. This may provide a mechanism for addressing key specialised topics not currently provided in a formal setting. However, limited professional development budgets, travel times and cost, and protracted processes for approval to travel/attend short courses, workshops etc. in larger regional towns is often a major impediment to participation in education and training opportunities (Robins and Dovers 2007). Pre-service preparation and in-service development of advisors and researchers for rural and remote locations, as is common practice for school teachers today (Green *et al.* 2013), should be undertaken by RD&E/A agencies, and could be supported by the ARS.



### *Informal opportunities*

In addition to more formal settings for acquiring new skills and gaining focussed information associated with working in rangelands, there are a wide range of possible informal strategies for gaining skills associated with career choices and development. Indeed, informal learning can comprise 70% of all learning (Myers 2011). During the World Café Session, information was sought on mentoring, leadership development programs and travel awards as potentially valuable opportunities for open-minded individuals to build skills, knowledge and networks. These methods of skill development also have great potential to also provide career advancement, however there are some notable constraints that limit application in many real-world settings. These barriers include an increase in reliance on short-term employment contracts, thereby limiting the time line for potential opportunities to be available, costs to the individual both in time and finances if expected without support, limited local capacity in rural and remote settings, and internal structures and cultures in some organisations that can impede uptake of these opportunities.

Mentoring is a valuable way to build and validate self-awareness and build a personal development program and career path. Indeed, most early career professionals have a strong desire for mentoring and support, and want more opportunities to access and work with mentors (Sherriff and King 2019). While the majority of mentoring relationships are initiated and maintained on an informal basis, a number of government, industry, R&D and professional bodies (e.g. Australian Rural Leadership Foundation (ARLF), National Farmers Federation (NFF), APEN, MLA) offer a range of well-regarded formal mentoring programs. Those serving as mentors can be peers or respected leaders from within or outside one's field. The latter could be invaluable in providing fresh perspectives on a wicked problem. The greatest success from these relationships will come through clear expectations, goals that align with topics and experiences that a potential mentor can offer, and regular interactions including time spent face-to-face (Reeve and Stephens 2019). A mentor should have the qualities one wishes to emulate, an extensive network, and be accessible and discreet. Mentors should be a positive influence, understand why they have been chosen and what is expected of them. The mentor should be prepared to put time into mentoring, to explore the mentee's strengths and weaknesses in the broadest sense, and be willing to listen and provide honest and frank feedback (Hund *et al.* 2018). In sharing their expertise and experiences, the mentor has a particularly important role in reducing the loss of corporate knowledge and expertise occurring with retirements today. However, it is important to recognise that the mentee alone is accountable for their career decisions, and that different mentors may be required at different stages of one's career. At the ARS 2019 conference attendees were offered an opportunity to participate in a mentor/mentee program designed to support early career attendees, especially those at their first conference. While considered generally successful during the conference, future programs would benefit from introductions between mentor/mentee matches earlier in the process to provide increased opportunities for focussed discussions on topics of importance

to the mentees. Given the importance of mentorship to the future success of early career practitioners, the ARS should consider supporting the creation of formal and informal mentoring relationships among members in the future, and publicising such events well in advance of its meetings.

### **Leadership development: paths, key skills and opportunities to build capacity**

Many individuals working in advisor/extension, researcher/scientist or producer/manager roles in the rangelands consider, or are asked to consider, taking on a leadership role at some stage in their careers. Leadership can be formal, such as a line management role within an organisation, or informal, such as an influential work colleague or peer, and both are important. There is an increasing recognition of the value of 'quiet leaders' (Rock 2006) within organisations; people who are often more junior personnel, with no formal leadership responsibilities, who lead upwards through their organisation and industry by their positive actions and attitudes. However, it is important to recognise that leadership is not for everyone. One can have a satisfying career and make a difference in the rangelands without being a designated leader. The desire to participate in leadership usually arises from a reflection on past experiences and what could occur in the future. Greater self-awareness is also important, but some action or event which had positive and/or negative consequences is often the trigger to the motivation to engage in leadership development (Allomes 2016).

Leadership development is an opportunity for personal growth, and should be seen as a journey that requires long-term investment. As such, it requires career management skills (FYA 2018), planning and commitment (i.e. time, money and life-long learning), set in a realistic timeframe. The personal return on this investment will include empowerment, self-confidence, new roles, success and personal satisfaction, along with some periods of deep frustration (Anderson 2018). The industry and community returns will include greater local capacity to lead, guide and provide strategic direction.

In thinking about future leadership it is important to reflect on the qualities of effective (and ineffective) leaders and the career path(s) that will lead to leadership roles. Core values of an effective leader include courage, honesty, respect for others, trust, integrity (Brosnan 2014) and authenticity (Freeman and Auster 2011). A current or prospective employer should be able to clarify the expectations of one's role, define career paths across the roles and units in the organisation and, at any given point in time, define what is required for career progression and attaining a leadership role. Access to training and support to assist people to move into leadership will be important. Remember that organisations change, and the communities, industries and environments they work with change, so leadership roles and the requirements for attaining them will also change over time (Quinn and Quinn 2016).

Brosnan (2014) identified three paths to leadership development: (i) self-leadership – the first steps largely undertaken on an individual basis, (ii) shared leadership – collaborations across agencies and organisations where you lead or are led by others, and (iii) state/national leadership where the focus is on influencing industry or government policy (Box 1).

**Box 1. Content for ‘Paths to Leadership’****Stage 1**

For an early-career advisor, researcher or producer, the first steps towards becoming a leader involve developing greater self-awareness – understanding one’s values, traits and motives and building capacity to lead oneself (e.g. time management, effective communication) while building self-confidence. It can be helpful to experience new locations or regions as a means of expanding one’s horizons. Developmentally, it is also important to emphasise key operating skills (e.g. meeting procedures, financial management) along with consolidating and expanding one’s knowledge (e.g. local practices and new ecosystems) and perspectives of key issues beyond one’s field/discipline(s). These experiences will enable increased capacity in integration and collaboration across scales and disciplines, and assist in identification of emerging issues in complex rangeland systems in the context of industry, government and community structures and issues. These first steps will take several years, and will include technical, scientific and local/experiential knowledge, and will require good listening, communication, facilitation, extension and relationship skills to create an effective network within an employing organisation and the wider community (Sherriff and King 2019). With regard to technical knowledge, do not rely on e-literature alone, as a lot of highly relevant rangelands research was conducted some 20–40 years ago. Much of this information is accessible by ARS members through the Society’s website in articles in *The Australian Rangeland Journal* (1976–1990) and *Biennial Conference Proceedings* (1977+). In this stage of development, it is also important to maintain energy and enthusiasm by identifying appropriate mentors and ‘like-minded’ people to engage with in developing one’s passion.

**Stage 2**

In this stage, developing leaders will be influencing team members as a collaborator or directing a small team, and perhaps nurturing a ‘Stage 1’ colleague. This requires understanding of how one thinks through challenges and well-developed ‘Stage 1’ skills, while also taking advantage of formal leadership training opportunities. Importantly, individuals at this stage may be offered collaboration, committee and perhaps team leadership opportunities early, but proceed with caution. These can build confidence, but not all roles are productive or will advance one’s career, and the consequences of being under-prepared and unsupported in a leadership role can be career limiting.

During this stage it will be increasingly important to initiate and manage change, source funds, engage traditional and non-traditional stakeholders, build effective multi-partnered collaborations, formulate and implement strategy, and apply one’s negotiating, conflict resolution, advocacy and mentoring skills. Here it will be important to listen, to learn how to build effective teams with complementary skills and learn interaction and communication techniques to ensure that all who might be impacted are included and heard. This includes working with internal and external stakeholders to define the problem(s) and possible solution(s). Understanding and applying knowledge, attitude, skills and aspirations (Bennett 1975) and strategies like the adaptive pathways framework (Marshall 2015) and co-design, co-production and co-dissemination of research (Galvin *et al.* 2016; Bestelmeyer *et al.* 2019) will ensure one’s work is adopted, has a positive impact and benefits rangeland enterprises and communities. This stage will probably run for longer than Stage 1.

Networks will be important for developing awareness of opportunities and potential mentors as one moves through the second stage. Technical skills become less important, and understanding an individual’s impact within the team becomes more important, along with working effectively with upper management. In this phase, anticipate some rejections and rebuttals of ideas, but these experiences and apparent crises are important for building humility and resilience, important qualities of an effective leader (Anderson 2018).

**Stage 3**

At this stage individuals will be explicitly recognised as a leader, either in a formal leadership role within their organisation and/or through peer recognition in an informal sense within their area of technical/industry speciality or the rangeland community. Expectations by others of one’s capabilities and potential are higher, which can bring its own pressures, but self-confidence is also generally higher. It is important at this stage to pay closer attention to work–life balance as time demands and opportunities increase.

All of the skills and behaviours listed for Stages 1 and 2 above are required, plus an understanding of industry and community issues, stakeholder engagement, strategy development, corporate governance, government processes and regulation, and diplomacy. Conceptual skills and emotional intelligence are particularly important here, and formal training (e.g. Master of Business Administration (MBA), Graduate, Australian Institute of Company Directors (AICD)) is usually a requirement.

After Brosnan (2014).

To be an effective leader requires certain skills and knowledge. Skills are what leaders must be able to do, and knowledge is what leaders must know or understand to be effective (Brosnan 2014). The key skills of effective leaders fall into several categories. The relative importance of each skill area will depend on the nature of the organisation, and the role, stage of career and position in the hierarchy. Within each of the skill areas, a number of key competencies have been identified for leadership across the roles of extension (Moore and Rudd 2004), research and development (Gritzo *et al.* 2017) and management of agricultural enterprises (Brosnan 2014; Allomes 2016; Heath

2017; Korff 2017). This information has been collated and blended into a list of key leadership skills and competencies, and enriched by the Early Career Workshop presenter’s and the author’s experiences (Box 2).

Across all three occupations, the following leadership skills and competencies are seen to be most important (in descending order of importance): communication, vision, listening, self-awareness, influencing, team building, strategy, stakeholder management and empathy (Brosnan 2014). Importantly, these are strongly aligned with the most important selection criteria in recruiting graduates for a wide range of occupations

**Box 2. Content for: 'Key skills for leadership competence'**

- **Human**
  - Relationship building (transparency, honesty, fairness and trust in networks and partnerships)
  - Open/approachable (receptive to new ideas and perspectives, sharing ideas)
  - Effective team player, impartial and transformational leader
  - Effective mentor/coach (valuing and encouraging ideas and the person)
- **Managing up**
  - Ability to evaluate, support and develop people (knowledge transfer and sharing)
  - Cultural awareness (values diversity and traditional knowledge, inclusive).
- **Conceptual**
  - Strategic thinking and planning (create and communicate vision, ability to set and achieve goals)
  - Dealing with uncertainty and embracing ambiguity
  - Decisiveness (even in the absence of complete information)
  - Critical and creative thinking (concepts and patterns in complex situations)
  - Organisational and social change (support and encouragement).
- **Technical**
  - Finance (source external funding, budgeting)
  - HR, IR, WH&S obligations, responsibilities and regulatory compliance
  - Project and business management
  - Computing, internet, data and platform technology (e.g. robots, drones) skills
  - Competency (depth of knowledge in one or more fields).
- **Communication**
  - Active listening skills
  - Speaking skills (quality presentations to groups of various backgrounds)
  - Reading skills (wide range of publications)
  - Written communication (adapting for various purposes and audiences)
  - Diplomacy and influence (interacting with people with various depths of knowledge and/or diverging points of view)
  - Media interaction.
- **Emotional intelligence**
  - Self-awareness (core values, strengths and weaknesses, personality type)
  - Self-reflection (impact of past actions and activities, successes and failures)
  - Self-regulation (emotional control, accountable)
  - Self-motivation (high standards and goals, motivating others)
  - Empathy (understanding others)
  - Courage to manage rather than avoid conflict.
  - Flexibility and adaptability
  - Resilience (ability to cope with crises and challenges).
- **Industry knowledge**
  - Farm/enterprise/industry experience
  - Structure, key players
  - Current and emerging issues
  - Awareness of global and national trends.

(GCA 2016). In descending order of importance: Interpersonal and communication skills, cultural alignment/values fit, emotional intelligence (including self-awareness, self-regulation and self-motivation), reasoning and problem solving skills, academic results, work experience, technical skills and demonstrated leadership (GCA 2016).

Options for building leadership capacity include formal and informal learning. Informal learning includes sharing knowledge and experiences with colleagues, action learning, feedback from peers and supervisor(s), and interactions through travel and visiting new environments. Formal options for leadership development include: (i) internal staff training courses offered by many employers, and (ii) external, early and mid-career

focussed development and training programs. Examples of external programs and travel opportunities relevant to early and mid-career professionals in rural and remote Australia are provided in the Professional Development page on the ARS website (ARS 2020a).

### Discussion and conclusions

The outcome of efforts to address the opportunities, challenges and threats identified throughout the 2019 ARS conference will depend largely on the capacity, capability and enthusiasm of the workforce available in the rangelands, now and in the future. Many of the skills and knowledge identified to meet these

current and future needs are not new, indeed the Australian literature highlights repetitive calls for strengthening people skills, conceptual knowledge, ‘bigger picture’/systems thinking and specific range science and management training. Fresh approaches to wicked and complex problems, involving collaborative approaches and a focus on usable science, promise significant progress but are totally dependent on having the right people with the right attitude, training and support to keep them working on the bigger issues of concern to rangeland industries and communities.

Extension/adoption will become a priority in R&D processes and projects, and new extension strategies and methods will be required to address the poor uptake of R&D. Advisors will target larger and younger producers, and will need the knowledge and skills to engage in large-scale projects with a greater diversity of stakeholders and producers who are more business and market focussed. Researchers will need to broaden their science/research focus to include ‘whole of farm’ and ‘triple bottom line’ implications, factor in extension/adoption in the design and delivery of research projects, and expand their networks to engage non-traditional participants, the private sector and international expertise. All three occupations will need to significantly enhance their social skills to make full use of collaborative RD&A processes, and advocate sound cases for public and private sector investments to address key issues in rangeland enterprises and communities. All three occupations will also need to be aware of global and national trends, and their local implications.

Australia’s rangelands offer many opportunities for fruitful and satisfying careers that involve both the art and the science of range management. We need to reflect on what we are doing, or could do, to attract and inspire the next generation of range professionals, and build their capabilities, but perhaps the biggest challenge will be retaining them. To attract the fresh and bright minds needed for industry and communities to innovate and prosper, we need to increase the exposure of young people to the rangelands and some of the passionate advisors, researchers and producers who work and/or live in the rangelands. This could be achieved by experienced operatives giving inspiring presentations to, or hosting visits by, senior high school, agricultural college and university groups, and by offering work experience placements to college or university students. This could be further developed by positive relationships between key representatives of potential employers (e.g. state agencies, pastoral companies and industry advocates) and respected regional education providers to nurture passion, develop understanding of current career options and build the knowledge and skills required for the rangelands. Such relationships would provide opportunities to identify and engage talented individuals, to identify and assign an appropriate and experienced mentor, and begin to nurture a future leader. Most new arrivals would need a short course on transitioning into a career in the rangelands, and would be well served with a ‘one-stop-shop’ source of information on professional development opportunities. An annually updated webpage on the ARS website could fulfil this need, and meet the Society’s goal of facilitating the exchange of information (ARS 2020b), but work is required to determine the real educational needs (demand) and to validate and evaluate the offerings (supply) of potential education and training providers. The limited awareness of ‘rangelands’ in urban areas suggests that any educational initiative(s) should aim

to ‘round out’ animal production and NRM/environmental science graduates, and as such should be postgraduate coursework focussed with multiple pathways for entry. There may be a need for the ARS to broker course development or assist in modifications of courses to fill gaps in offerings. Associated with this, the ARS could initiate and support a formal mentoring scheme and include several young professional-related events at every biennial conference. These could include workshops on transitioning into a career in the rangelands, topical issues or opportunities for specific skills development; for example science communication, review and discussion of recent policy updates that are important for rangelands; or practice job interviews/job application preparation reviews among others. These activities should be actively promoted in any marketing of ARS biennial conferences, with attendance perhaps supported by an ARS student award(s). The structure and content of these events should be based on surveys of students and young professional’s experiences at the most recent conference and their perceived future needs. There was an acceptance of job mobility among the early career professionals, but rangeland communities, experienced professionals and the ARS should be advocating for retention of longer-tenured positions in rural and remote Australia and resisting the push for centralisation (Stafford Smith and Cribb 2009). Improvements in employment packages, living conditions, internet services and health, education and welfare support will encourage a greater interest and commitment to work in the rangelands, and, importantly, help to retain those with a passion for the rangelands.

A key strategy for students and young professionals entering the field is to learn what motivates them and what their values and passion are as these give a sense of direction for making decisions throughout their career that will lead to rewarding employment/work choices. Future rangeland practitioners should be particularly mindful of developing flexibility, and in being open to challenges, opportunities, up-skilling and new roles. Exposure to new situations and circumstances has the potential to expand individual experiences into having the confidence and knowledge to handle unprecedented conditions.

Beyond the key attributes of passion and attitude, a wide diversity of knowledge and skills will be required to work effectively in the rangelands, with other stakeholders, on current and emerging issues (Nielsen *et al.* 2020). The challenge is to be humble and open-minded, and use these skills to take a proactive, collaborative and outcomes-focussed approach to issues, to aspire to ‘best practice’, and to learn and grow. The lists of skills and knowledge outlined in this paper may seem daunting to a student or young professional, but a reality of working in the rangelands is that an advisor/researcher/producer needs to be ‘ready for anything’ and ‘open to anything’. It is hoped that this collation and integration of information on the expectations of key roles and the pathways for professional development will provide some guidance for a successful career and leadership roles in range science and management. It is important to recognise that it will probably take a career to fully develop the recommended skills! A willingness to engage in lifelong learning is clearly the key.

It seems inevitable that we will see more participants in range science and management without a strong connection to, or knowledge about, rangeland systems (Heath 2017), and while

these people can bring fresh insights and ideas to the rangelands, this issue highlights a need for accessible range-specific education and training for professional development. Five years ago, Roxburgh and Pratley (2015) expressed concern about the capacity to teach range science and management in Australian universities, and thus inspire and prepare the next generation of advisors, researchers and producers. The recent web search confirms a lack of range-specific programs and courses, and a serious decline in the capacity to teach range science and management in Australia. Yet, the economic, environmental and social value of this 80% of Australia's land is significant (Foran *et al.* 2019), and surely warrants renewal of range science and management education. A strategic approach to capability building is required, but we cannot rely on the higher education sector to do this. An analysis and forecast of the capacity, skills and knowledge required to service the needs of rangeland industries and communities in 2030–2035, an audit of current higher education offerings and their relevance to the expressed needs, and an assessment of potential demand should be undertaken now to underpin any initiatives and investment in building human capital. These findings will provide context for the future needs in knowledge and skill development, and must be framed in a positive narrative about the economic, environmental, cultural and social value of our rangelands (Foran *et al.* 2019; Traill and Stafford Smith 2020).

Capacity building, skills and knowledge development and retention should be high priorities for the people living and working in the rangelands, those who make administrative and policy decisions that impact the rangelands, and the Australian Rangeland Society. People are at the crux of most of today's issues, and the critical element in ensuring the viability of the livelihoods, the integrity of the ecological systems and a resilient future for our rangelands.

### Conflicts of interest

The authors declare no conflicts of interest.

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