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Toward land restoration transitions: elevating regional voices and the provenance of co-benefits in Queensland rangelands

Nikki P. Dumbrell[A,*], Catherine J. Robinson[B,C], Katie D. Ricketts[A], Danilo Urzedo[B], Lisa Walker[D] and Anthelia J. Bond[E,F]

For full list of author affiliations and declarations see end of paper

***Correspondence to:**
Nikki P. Dumbrell
CSIRO Agriculture and Food Business Unit, Black Mountain, Canberra, ACT 2601, Australia
Email: Nikki.Dumbrell@csiro.au

ABSTRACT

Land management changes are and will continue to play a substantial role in national and global strategies towards decarbonisation goals. Yet, roles for land managers and their communities to co-create opportunities for just transitions are not well represented or accounted for in policy instruments or markets, including those for carbon offsets. Understanding regional context is critical to identify strategies for land management changes to underpin just transitions. We outline a mixed-methods approach involving an analysis of socio-economic data and a critical review of regional plans to identify the benefit aspirations that communities have articulated, and the drivers of transitions already at play to understand how land sector carbon abatement projects could support regional transitions. This approach is demonstrated using a case study region in Queensland, Australia. The case study region hosts land sector carbon abatement projects under a national policy that incentivises least cost abatement and under a state policy that incentivises land sector carbon abatement with bundled environmental and social co-benefits. The results show that across sectors and locations, communities are seeking economic, cultural, and social outcomes that can be delivered as co-benefits of land management changes for carbon abatement. Our analysis shows that the value of multiple co-benefits is place-specific and dependent on the provenance of land management changes and broader regional conditions. By understanding regional contexts and aspirations, it is possible to identify how and where land sector carbon abatement investments can be negotiated between investors and communities to support just transitions to low-carbon futures.

Keywords: carbon farming, decarbonisation, just transitions, land use change, place-based benefits, regional planning, regional provenance, social co-benefits.

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Introduction

Rangelands hold an estimated 30% of global terrestrial carbon stocks (Neely *et al.* 2009) and are slated to play a critical role in supporting national and global decarbonisation goals, such as those set out in the Paris Agreement (Booker *et al.* 2013; United Nations 2015). This is driving environmental and socio-economic transitions for rangelands and dependent communities across the globe (Foran *et al.* 2019; Liao *et al.* 2020; Swette and Lambin 2021). While there is biophysical potential for rangelands to contribute to decarbonisation goals (Nolan *et al.* 2018), this potential will only be met if required land management changes, including land restoration activities, are implemented. Enabling transitions to low-carbon land management strategies relies on investors engaging with land managers and their communities in ways that ensure equitable distributions of benefits for long-term success (Di Sacco *et al.* 2021). This suggests that where, how and by whom land management changes for carbon abatement are implemented, and the surrounding social context is important (Green and Gambhir 2020; Londres *et al.* 2023). Despite this, considerations of how regional realities can shape community perceptions of land restoration opportunities or concerns about perverse outcomes of

land sector carbon abatement projects and their effects on regional communities are rare (Curry *et al.* 2022; Jassim *et al.* 2022).

Given successful moves to low-carbon economies will depend on communities experiencing meaningful benefits, this paper analyses how regional contexts can inform modes of decarbonisation through land restoration transitions. Civil society, social movements, and Indigenous communities have challenged and elevated the critical role of justice practices in enabling the implementation of transitions through land restoration efforts (Urzedo *et al.* 2022). Where just transitions formulations emerged from labour rights movements (Evans and Phelan 2016), the international climate agenda has expanded these dimensions to embrace the inclusion of distributive, recognition, and procedural justice principles in sustainability decision-making and implementation processes (Heffron 2022). Global climate policies particularly address just transitions in terms of how the implementation of response measures can enhance place-based conditions of decent work, quality jobs, and socio-economic realities (UN-DESA 2022). In low-carbon economies, considerable attention has been directed towards analysing how the energy and mining sectors adopt just transitions pathways, while there is limited understanding of the impact of land restoration efforts (KCI 2023).

Drawing on a case study approach and employing a review of regional plans and analysis of socio-economic data, we seek to understand the benefits communities are seeking as well as the challenges confronting them. We do this to understand how co-benefits and provenance aspects of land sector carbon abatement investments can help support just transitions and place-based benefits. Understanding carbon abatement provenance and co-benefits and how they interact is critical for rangeland regions that are characterised by land-based economies facing uncertainty and acting as growing hotspots for external investments for sustainability pursuits (Nori and Scoones 2023).

Co-benefits, impacts and transitions of land management changes

Co-benefits are the positive effects that a policy or measure aimed at one objective might have on other objectives, irrespective of the overall impact on social welfare (IPCC 2014). In climate policy, the notion of co-benefits has been expanded over the past two decades to consider the existence of a range of benefits that emerge from specific interventions (IPCC 2014; Pörtner *et al.* 2021). Assessments of carbon abatement strategies show that co-benefits are often conceived and assessed on the basis of global and national priorities (Deng *et al.* 2017) and in the instance of land sector carbon abatement, at the farm-scale. For example, co-benefits associated with land sector carbon abatement have been closely examined as incentives for landholders to adopt land management changes (Kragt *et al.* 2017). Evidence from maturing public and private markets for land sector carbon abatement in Australia also shows that despite financial returns being heterogeneous across landscapes (Paul *et al.* 2013; Dumbrell *et al.* 2017), land managers can access improved agricultural production and other co-benefits from land sector carbon abatement projects (e.g. Summers *et al.* 2021).

However, co-benefit delivery is not always perfectly synergistic with the core component of interventions (e.g. carbon abatement) and trade-offs typically have to be made (Onaindia *et al.* 2013). Different co-benefits and incentives to deliver them also appeal across communities and sectors (Feng and Kling 2005). The delivery of different co-benefits is also not perfectly synergistic, and trade-offs can be required among environmental co-benefits or between environmental and social co-benefits, for example. Although there is evidence that the public is willing to pay for co-benefits from land restoration (Kragt *et al.* 2016) and financial mechanisms can be designed to encourage participation in co-benefit projects (Bottazzi *et al.* 2013), there are limitations to placing market values or creating financial mechanisms for broader culturally and socially relevant co-benefits associated with land management change (Robinson *et al.* 2016*a*, 2016*b*). To overcome these challenges, it is critical to understand the socio-economic and cultural context within which land management changes are or are proposed to be implemented (Jackson *et al.* 2017; Baumber *et al.* 2020).

The socio-economic contexts of regions where land sector carbon abatement projects are proposed or implemented and the co-benefits that may be generated at this scale have not attracted the same attention as the context and potential impacts of land management changes at the farm-scale. This is despite these broader conditions and community agency also driving the adoption and acceptance of carbon abatement activities (Baumber *et al.* 2022). In other words, the regional provenance of carbon abatement projects is important to adoption and the forms of mobilising co-benefit delivery at the community level.

Provenance captures components of the origin of a good or service with elements of where, who, and how it was produced, traded, and held (Oxford Dictionary 2022). Here, we consider the regional provenance of land restoration activities and co-benefits covers where, who and how activities are implemented and propose that these attributes carry inherent value. This formulation reflects the inextricable links between co-benefits and provenance; co-benefits often depend on local circumstances and implementation practice to materialise (IPCC 2014), and valuing, certifying, and protecting provenance has also been a critical input into regional economic development strategies (Morgan *et al.* 2008; Gangjee 2017; Reisman 2022).

In this paper, we focus on the regional provenance of carbon abatement and co-benefits to analyse how contexts and communities are considered when designing and evaluating the impacts of land restoration transitions. Indeed,

the regional provenance of carbon co-benefits is especially important in rangeland regions, where co-benefits can fill gaps in service delivery, and support economic or social outcomes. For example, research in Australian rangelands shows that financial, job, community, and infrastructure co-benefits of public and private investments are an important pathway to accessing basic services and attracting and retaining a population to support further investment and growth in remote regions (Pittock 2011). Studies suggest that carbon abatement projects can offer multiple benefits, including offering socio-ecological resilience by diversifying land uses and income streams, and enabling interactions with lands to support well-being (Robinson *et al.* 2016*a*; Baumber *et al.* 2020). However, the challenge is to ensure that regional voices can inform whether and how carbon abatement projects and co-benefits are designed, implemented, and evaluated. In remote rangeland regions, it can be difficult to capture these voices. For example, rangeland populations can be highly mobile, which makes participatory research less predictable and/or resource intensive (Ochieng *et al.* 2018) and those that can be reached for surveys tend to reject substantial numbers of requests (ABS 2015). Obtaining quality secondary data and information about the views and priorities of people in remote rangelands can also be a challenge (Le Tourneau 2020). This paper addresses this challenge to critically reflect on how socio-economic data and regional plans can provide investors and communities with the information needed to negotiate regional provenance and co-create just land restoration activities in the rangelands.

Land restoration transitions in Queensland, Australia

Investments in land sector carbon abatement projects are a key strategy being employed to meet decarbonisation goals in Australia (DISER 2020). This paper draws on the Queensland Land Restoration Fund (LRF) program as an example of a state government investment incentivising land restoration and carbon abatement. The LRF is a AU$500 million program designed to enable and financially reward landholders to provide land sector carbon abatement *and* priority environment, socio-economic and First Nations benefits (DES 2021, 2023*a*). The approach the LRF uses to prioritise investments for co-benefits has origins in the sustainable livelihoods framework (Scoones 1998) and to verify co-benefits has origins in the REDD+ Social and Environmental Standards and Climate Community and Biodiversity Standards (CCBA 2017). With these origins, the LRF has established a Priority Investment Plan (DES 2021) and Co-benefits Standard (DES 2023*a*), which together provide guidance on investing in and conducting land restoration projects that deliver carbon abatement and provide net positive benefits for local communities and biodiversity.

The LRF investment in land restoration transitions is underpinned by the Australian Carbon Credit Unit (ACCU) Scheme, designed to support progress towards national emissions-reduction targets (43% below 2005 levels by 2030 and net zero by 2050; Fig. 1). The ACCU Scheme sets out the methods that can be used to achieve carbon abatement and verify abatement, and holds a register of all eligible carbon abatement projects (including LRF projects). Since 2015, registered projects have been able to sell carbon abatement to the Australian Government at a price agreed via a reverse-auction process. The Australian Government has used this mechanism to buy the least-cost abatement (Burke 2016). With a purposeful approach to investing in co-benefits, the Queensland LRF program is differentiated from the ACCU Scheme and represents an example of an approach that pays attention to the co-benefits of projects that accrue to landholders and surrounding communities, and the provenance of carbon abatement projects in the landscape. Ultimately, the land management changes, and co-benefits prioritised by the LRF, are part of a nested system of regional, national and international goals and priorities (Fig. 1).

Southern Queensland Landscapes natural resource management region

Land restoration transitions are taking place in Queensland rangelands, with a high concentration of ACCU Scheme projects and emerging LRF investments. The Southern Queensland Landscapes natural resource management (NRM) region was selected as a case study area on the basis of several regional characteristics, including the intersection of rangeland environments and investments in land restoration and carbon abatement. The Southern Queensland Landscapes is 1 of 56 NRM regions in Australia (NRM Regions Australia 2023), with actions in each region reflecting the emphasis of NRM planning and decision-making on landholders and community actions to meet sustainability goals at local and regional scales (Lane *et al.* 2009).

The Southern Queensland Landscapes NRM region is 314 398 km^2 (Fig. 2). The region covers approximately 18% of Queensland and spans six bioregions and four climate zones (DES 2013). Approximately 8% of the region is in national parks, nature refuges, and state forests, with the remaining land use being dominated by grazing at 83% (Southern Queensland Landscapes 2022). Particularly in the west of the region, the grazing industry has a history of managing woody vegetation, e.g. clearing regrowth (Witt 2013). The profitability of the grazing industry is tied to climate conditions, with droughts not infrequent, the capacity to control pests (e.g. wild dogs are a substantial challenge to sheep and wool production) and costs, particularly labour and transport costs to remote locations (Southern Queensland Landscapes 2022). Mining, construction and the agriculture, forestry and fisheries industries dominate the regional economy (Southern Queensland Landscapes 2022).

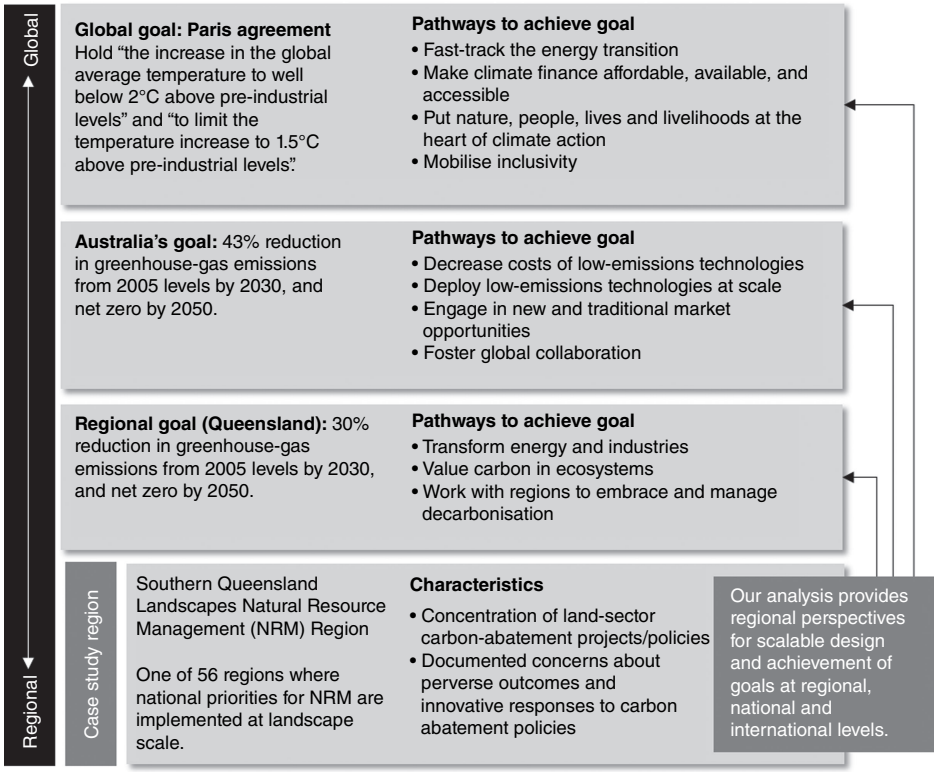

Fig. 1. Regional- to global-scale case study context. Sources of information used in figure: United Nations (2015), DISER (2020), Al Jaber (2023), DES (2022) and Yarnold *et al.* (2022).

The region hosts the most registered land sector carbon abatement projects under the ACCU Scheme of any NRM region in Australia (132 as of 2021; Curry *et al.* 2022) and hosts five LRF projects (as of May 2023; DES 2023*b*). With the accumulation of land sector carbon abatement projects in the region, there is growing evidence that investments in these projects are creating both opportunities and tensions where carbon abatement project objectives do and do not align with regional objectives for sustainable development. For example, the region is home to innovative place-based groups of landholders exploring and mobilising investment in economically and socially sustainable environmental outcomes in response to public and private environmental policies and market signals (e.g. Ward and Clarke 2023). At the same time, with the growth of land sector carbon abatement projects in parts of the case study region, concerns regarding perverse outcomes such as land absenteeism and rural decline, are coming to the fore (e.g. Curry *et al.* 2022; Jassim *et al.* 2022; Queensland Reconstruction Authority 2022).

Research methods

Our analysis of co-benefits and transition pathways that can be associated with land restoration was guided by the LRF Co-benefit Standard (grounded in international frameworks; DES 2023*a*) and the transitions literature, which notes the importance of capacity, challenges and pathways to meet regional aspirations (Bryan *et al.* 2013; Dewi *et al.* 2017; Everingham *et al.* 2022). First, we examined data describing the economic and social characteristics of the case study region, so as to understand the regional context where co-benefits and transitions to decarbonisation may be realised through land sector carbon abatement projects. Following this, we analysed regional plans that articulate community benefit aspirations across sectors within the Southern Queensland Landscapes NRM region. This plan review also focused on the identification of regional challenges and transition pathways and how these may interact with transitions involving land sector carbon abatement investments. Our analysis was designed to include these regional datasets to understand where and how (the provenance) the co-benefits prioritised and valued by the LRF program can be negotiated to suit the regional context.

Socio-economic analysis of regional context for land sector carbon abatement investments

The economic geography of the case study region was analysed to contextualise results and show the potential impact of prioritising co-benefits and regional provenance alongside the carbon outcomes of land sector carbon abatement projects. The detailed regional analysis was conducted using data for local government areas in the Southern Queensland

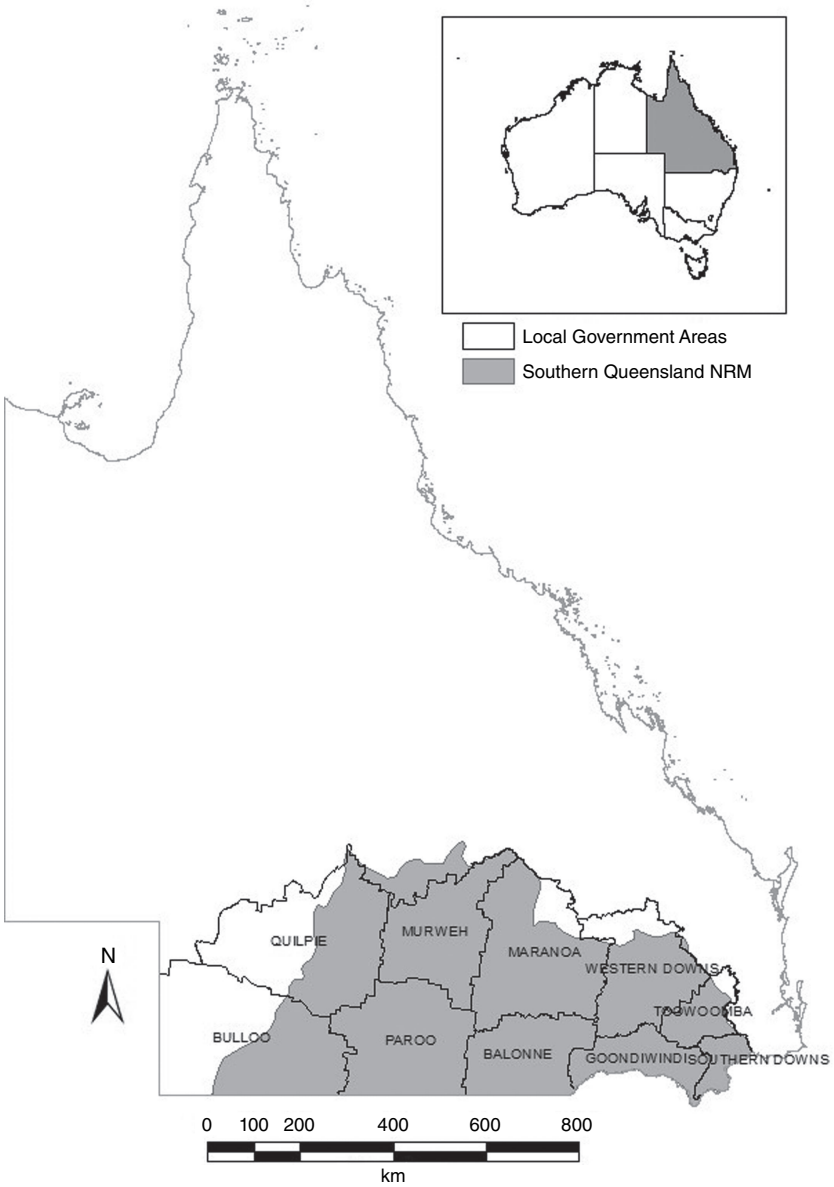

Fig. 2. Map of the case study area and local government areas with substantial area in the Southern Queensland Landscapes natural resource management region.

Landscapes NRM region. Local government areas provide a good spatial representation of local communities and economies because they generally encompass at least one major town and represent the scale at which much regional and community planning is conducted. To make comparisons, and highlight regional specifics for the case study region, an analysis was also conducted for Queensland.

We sourced population, employment and occupation data from the 2021 Census conducted by the Australian Bureau of Statistics (ABS 2022*a*) and from the Regional Development Australia regional economic profile for the region (Informed Decisions and Regional Development Australia 2023) and business data from the Australian Bureau of Statistics Business Register (ABS 2022*b*). The Agriculture, Forestry and Fisheries division of the Australian and New Zealand Standard Industrial Classification was a focus industry in this analysis because this is the industry most engaged in land sector carbon abatement activities. This classification includes businesses and employees engaged in production (e.g. growing crops, raising animals, growing, and harvesting timber), and support services to production (ABS 2013). Collectively, these data show the area's role within the broader Queensland economy, regional strengths and specialisations and opportunities and constraints for future development pathways, including through land sector carbon abatement projects.

An analysis of investments in land sector carbon abatement projects in the case study region was also conducted on the basis of publicly available information in the ACCU Scheme and LRF project registers (Clean Energy Regulator 2023*b*; DES

2023*b*) and ACCU Scheme auction results (Clean Energy Regulator 2023*a*). These registers also include information on the local government area(s) that projects are based in.

Review of regional benefit aspirations and drivers of change

Regional plans set strategic directions for communities to grow and respond to change over time. Beyond the Queensland context, the Australian Government is also embarking on regional planning as a mechanism to guide sustainable transition pathways aligned with a wide range of environmental, economic, and social outcomes that are driven by the needs of communities and their environment (DCCEEW 2022). Regional plans developed in consultation with communities and stakeholders assemble multiple perspectives of challenges and benefit aspirations, reflecting interests, values, and realities, and outline key actions to achieve goals or deliver regional economic, social, and environmental outcomes.

Three types of regional plans that articulate public values were selected for content analysis to understand the aspirations of communities, drivers of change and sustainable transitions pathways available in the case study region. The three types of plans each represent diverse communities and detail choices and actions of and for organisations that have a role in regional governance for land restoration transitions (Agrawal *et al.* 2022). The three plan types reviewed include the following: (1) local government community or corporate plans, economic development plans, annual reports and regional resilience strategies produced by the 10 local governments in the Southern Queensland Landscapes NRM region (Fig. 2); (2) the Southern Queensland Landscapes NRM plan and annual report; and (3) plans and strategy documents produced by three First Nations Native Title Prescribed Body Corporates and cultural services organisations active in the region. A list of the documents reviewed in each category is included in Table S1 in the Supplementary materials. Each plan included in the analysis had a time horizon of 5–10 years, and only current versions of these plans were considered in scope. Where annual reports were included (local governments and NRM organisation) the document for the 2021–22 financial year was analysed.

Local government corporate plans are a statutory obligation that speak to the six roles of local governments, including the following: (1) provide services to the community; (2) fund community services; (3) regulate activities; (4) partner with other parties to deliver outcomes in the interests of the community; (5) facilitate groups to come together to deliver outcomes in the interests of the community; and (6) advocate for community outcomes to other decision-makers or influencers. As part of the regional NRM model, NRM organisations in Queensland are governed by community-appointed boards charged with representing the perspectives and priorities of their regional community. Regional plans identify priorities, align with policy and legislative requirements, and outline adaptive partnership and knowledge-based approaches to landscape-scale social-environmental system management to support the achievement of national priorities at the landscape scale. First Nations-driven co-governance regimes created within government legislative structures, such as Native Title Claims or Indigenous Protected Areas, enable and require First Nations-led decision-making and planning for landscapes and communities. The purposeful selection of plans representative of these organisations for this analysis reflects their crucial role in regional planning and governance for priority outcomes across environmental, economic, social and cultural domains (Duncan *et al.* 2018).

We undertook a critical review of the plans to evaluate narratives that shape the transition practices and perspectives at the regional level (Grant and Booth 2009). By using Atlas.ti Web (version 5.8.0, https://atlasti.com/atlas-ti-web) software, we conducted a qualitative analysis of the selected regional plans to identify both benefit aspirations and drivers of change in the region. A codebook was developed through a combination of inductive and deductive analyses of the plans. This process resulted in the establishment of a set of codes (Table 1). Coding was performed to identify the content, patterns, and frequency of specific forms of benefit aspirations and drivers of change across different plan types. The benefit codes reflected the priority socio-economic and First Nations co-benefits outlined in the LRF Priority Investment Plan and Co-benefit Standard (DES 2021, 2023*a*). Specifically, our focus was on Priority 3 of the LRF Priority Investment Plan, 'land restoration for social and economic sustainability', which prioritises carbon abatement projects that can generate new income streams for regional communities, deliver economic opportunities for First Nations peoples, and engage key regional industries. The Co-benefit Standard details how priority benefits can be generated. Of specific interest to this study, the Co-benefit Standard refers to the following: (1) employment and skills benefits delivered through projects employing regional workers and or delivering skills training in regional Queensland; (2) local-community benefits derived by projects taking place in relatively disadvantaged areas, using local businesses and suppliers, and other local community engagement in projects; and (3) First Nations benefits as a consequence of carbon abatement projects taking place on First Nations land and or through the involvement of First Nations people. The remaining two priorities in the Priority Investment Plan were of less focus in this study and relate to environmental outcomes, namely land restoration to improve the health of wetlands, including the Great Barrier Reef and for threatened species and ecosystems. The codes for drivers of change were initially derived from major regional and landscape transitions in the existing literature (Bryan *et al.* 2013; Dewi *et al.* 2017; Everingham *et al.* 2022) and adapted to include additional themes emerging from the regional plans.

Table 1. Benefit aspirations and drivers of change described in regional plan documents and corresponding codes.

Domain	Description
Articulated benefit aspirations	
Economic benefits	Economic benefit to regions, including investment, revenue, and multiplier effect of business revenue spent regionally and creation of new jobs and/or the maintenance of jobs that would otherwise be lost.
First Nations benefits	Engagement of First Nations peoples in and leadership of initiatives (environmental, economic, community). Also includes actions and benefits accruing on First Nations lands (on Country).
Skills benefits	Attraction and retention of in-demand skills, and skills development and training opportunities provided in regions
Social benefits	Social and liveability outcomes for regions, including regional community resilience, support for the rights, representation, and participation of socially diverse and minority groups (women, First Nations peoples, people with disabilities, people from non-English speaking backgrounds, or LGBTIQA+ people) in meaningful pursuits.
Drivers of change that influence transition pathways	
Economic factors	Changes in market demand, incentives, taxation, profitability, availability of external funding for actions or outcomes as well as population movement to cities (e.g. for education or employment opportunities) or population movement to the region affecting local workforce and demand for goods and services. Development or growth in the service sector of the economy (e.g. agricultural technology development, tourism), which may represent a shift to a diversified economic base with less dependence or demand on extractive natural-resources industries.
Environmental changes	Response to environmental change or challenges such as climate change. Includes reference to building climate resilience as well as experiences of budgeting to allocate resources to respond to environmental changes and, consequently, moving resources away from other valued uses.
First Nations values	Support for or mainstreaming of First Nations values and principles of valuing nature and wellbeing, including diverse knowledge systems, and culture.
Partnerships and networks	Connections among people, communities, and organisations, including external brokers and local agreements and institutions that assist in implementing plans and actions.
Policies and regulations	Changes in property rights and land-use planning, regulations and protections, procurement policy, and other policies across scales that can shift supply and demand in major industries (by employment and value).
Skills	Description of skills needs for the future to respond to challenges or capitalise on opportunities. Also includes reference to why or how incentives are needed to develop skills to underpin employment opportunities.
Technology	Development of scientific practices, monitoring, analysis, scenarios, and new technologies that could drive a shift away from business-as-usual and demand different skills. Also used to note infrastructure, planning or investments needed to underpin the development of technologies or practices (or the capacity to adopt these).

Sources: DES (2023*a*), Everingham *et al.* (2022), Dewi *et al.* (2017), Bryan *et al.* (2013).

Results

Our results highlighted that regional context shapes the extent to which communities can take on and value carbon abatement projects with co-benefits.

Understanding regional context for land sector carbon abatement investments

The economic and demographic profile of the case study region indicates a specialisation in and reliance on certain industries. In particular, the region is highly specialised (location quotient >2; Table 2) in the agriculture, forestry, and fishing industry (including in primary production and service roles). A high location quotient is a product of the relative contribution the industry makes to the local economy and the proportion of people employed in the industry in this region relative to the rest of Queensland. Data from 2022 also showed as many workers as jobs available across all industries in the case study region, but more jobs than workers in the agriculture, forestry, and fishing industry (Table 2). These statistics are likely to reflect both the agriculture, forestry and fishing industry specialisation of the region, and the macroeconomic conditions in Australia more broadly at the time (e.g. low unemployment). The residents of the region also tend to work locally, including living and working in the same local government area and within the case study region (Table 2).

Collectively, the investment in carbon abatement *and* priority environmental, social and First Nations co-benefits across five LRF projects in the Southern Queensland Landscapes NRM region is A$24.95 million (DES 2023*b*). As of 2021, 132 ACCU Scheme land sector carbon abatement projects were also located in the region (Curry *et al.* 2022). This is approximately one-third of all projects in Queensland (Clean Energy Regulator 2023*b*). Using average reverse-auction prices released publicly by the Clean Energy Regulator, the entity responsible for administering the ACCU Scheme, and the amount of carbon abatement reported and credited by these projects, A$261.6 million

of revenue has been generated in the Southern Queensland Landscapes NRM region in the 10 years since the first project reported abatement (Clean Energy Regulator 2023*a*, 2023*b*). Despite the relative concentration of land sector carbon abatement projects in the region, the economic contribution of the land sector carbon abatement industry pales in comparison to the agriculture, forestry, and fishing industry in the region (Table 2). This analysis, therefore, suggests that the co-benefits of land restoration for carbon abatement may be much more valuable to regional communities.

Regional plan articulations of co-benefit aspirations and transition pathways

Communities in the Southern Queensland Landscapes NRM region are aspiring to secure the priority socio-economic and cultural co-benefits that are valued by the LRF program (outlined in DES 2023*a*). Sought-after benefits include economic benefits, benefits for First Nations communities and lands, skills development benefits and social and community benefits (as defined in Table 1) in addition to environmental benefits (Fig. 3*a*). The most commonly sought-after benefit

Table 2. Southern Queensland Landscapes NRM region and Queensland population, businesses, and jobs statistics.

Item	Southern Queensland Landscapes[A]	Queensland
Population	284 871	5 156 138
Percentage identifying as First Nations peoples	5.7	4.6
Median age	38	38
Businesses	32 579	484 277
Value added (A$) agriculture, forestry and fisheries industry	2 837.9 million	69 217.07 million
Value added (A$) all industries	17 880.6 million	333 433.2 million
Employed persons	137 387	2 444 088
Jobs	144 144	2 582 800
Jobs in agriculture, forestry, and fisheries industry	13 386	65 268
Jobs to workers ratio in agriculture, forestry, and fisheries industry	1.05	0.97
Jobs to workers ratio all industries	1	0.98
Live and work in same local government area (%)	88.7	78.5
Live in the area and work in a different local government (%)	2.4	n/a
Live in the area, but work outside the area (%)	4.8	n/a
Location quotient (compared to Queensland) for agriculture, forestry and fisheries industry	3.66	1

[A]Notes: data for 10 local government areas with substantial area in the Southern Queensland Landscapes NRM region (Fig. 2). Data from: ABS (2022*a*, 2022*b*) and Informed Decisions and Regional Development Australia (2023).

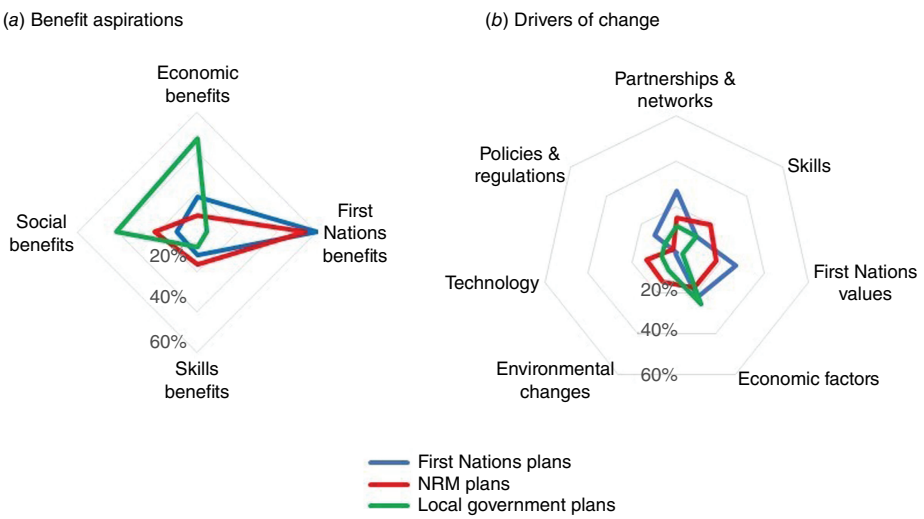

Fig. 3. (*a*) Relative frequency with which three types of plans (First Nations, NRM and local government plans) mentioned four focus benefits. (*b*) Relative frequency with which three types of plans mentioned seven different drivers of change. Note: in each graph, the relative frequency is calculated for each plan type, not for each benefit or driver of change. Benefit aspirations and drivers of change are described in Table 1.

was regional economic improvement associated with business and government investment in the region, creating and maintaining local and diverse employment opportunities, buying local, and resourcing public goods. This was followed by social benefits, First Nations participation and land benefits, and skills benefits. Although the alignment between priorities in the LRF Priority Investment Plan and regional plans was clear, the scope of benefits in the regional plans did extend beyond the carbon abatement focus of the LRF documents. For example, while regional plans could be agnostic to the industry that job opportunities or skill development may be associated with, the LRF Priority Investment Plan and Co-benefit Standard outline how these could be achieved through investment in land sector carbon abatement projects.

Across plan types, the First Nations Native Title and Cultural Services plans focussed mostly on the benefits of First Nations participation and lands. Local jobs for First Nations peoples were also of high priority (more than half of all economic benefits coded in the First Nations plans; Fig. 3*a*). For example, one plan prioritised accessing 'opportunities for economic development and employment', and maximising 'economic participation for our people by ensuring access to quality vocational training and the pursuit of real jobs and business opportunities from all project developments' (Bigambul Native Title Aboriginal Corporation 2018, pp. 8–9). Likewise, the NRM plan for the region recognises and seeks to support First Nations' ongoing custodianship and participation in environmental planning and investment decisions. Another key aspiration of the NRM plan was maintaining and building social capital in the communities that care for and value the landscape (Fig. 3*a*); this included building connections between people and the environment, and between community networks and volunteer groups to support community well-being and a sense of belonging. Likewise, the local government plans aspire towards community social benefits in the form of inclusion and belonging (Fig. 3*a*).

Local government plans also frequently referred to economic benefits such as increasing local business and industry activity and diversity to support economic resilience. Employment opportunities and building local skills were also seen to deliver economic benefits by increasing local expenditure and providing opportunities for younger people to stay in the region to contribute to vibrant communities. This was particularly pertinent in the most remote western rangelands of the region where rural decline and outmigration were noted as a concern in plans. The land sector was also noted as a source of economic benefits for the region. However, within this, there were conflicting views on how this could be sustained with the introduction of land sector carbon abatement projects. For example, one local government economic plan from the east of the case study region considered the possibility of exploring 'emerging environmental stewardship opportunities' (Southern Downs Regional Council 2022, p. 21). Whereas another from the rangelands in the west of the region viewed land sector carbon abatement as having 'adverse impacts on the area's productive agricultural land' (Quilpie Shire Council 2020, p. 8).

The frequently mentioned aspirations were also highly interconnected; for example, initiatives to support economic development related to agriculture, tourism and other activities were also referred to in the context of supporting the attraction and retention of skilled workers and therefore new residents to communities to, in turn, create additional social and community liveability benefits. Most notably for a program such as the LRF that is seeking to invest in environmental and social benefits, the plans all referred to inherent links between the environment and communities. For example, the environment was commonly referred to as providing communities with things they need and want, such as, for example, inputs for agricultural production, recreation, and tourism opportunities (local government plans), agricultural production, recreation, and connections to place and nature (NRM plans) and cultural connections and livelihood opportunities (First Nations plans). However, in the most part, plans were agnostic about the source of local employment opportunities, for example, being indifferent to whether employment is associated with carbon abatement projects relative to conservation or ranger programs, agriculture, tourism, renewable energy, or other industries.

The aspirations described by each of the plans also correlated to the levers available to initiate change towards achieving these aspirations. For example, the First Nations plans highlighted the need to recognise and include First Nations values and principles of valuing nature, diverse knowledge systems, and culture in decision-making to achieve aspirations for First Nations peoples and lands (Fig. 3*b*). Likewise, local government community and economic plans emphasise economic levers as critical. This is likely to reflect that local governments are reliant on the Queensland State Government for funding for basic services and are able to direct funding to priority issues or opportunities.

Across all plan types, and especially for the local government plans, economic factors were the most substantial driver of change (Fig. 3*b*). Economic drivers capture the intersection of the region's industries and businesses with changing market conditions (e.g. increasing demand for sustainably produced outputs), broader macroeconomic trends, and funding available for investment in local communities, including via the organisations writing the analysed plans. Population changes were also key economic drivers noted in the local government plans. In the east of the case study region, population growth is raising questions about the capacity of the region to invest in and support the infrastructure (e.g. affordable housing) needed and, in the rangelands in the remote west of the region, attracting and retaining skilled workers to maintain or grow the population

is critical to maintaining basic services such as health and education. Environmental changes, such as climate change, were also identified as demanding the reallocation of resources from productive uses towards other uses, such as, for example, maintaining or repairing damaged infrastructure following repeated flooding (local governments) and redesigning the priorities and ways of working for organisations in the region. The NRM plan also highlighted the intersection of environmental changes and economic drivers with 'pressures of drought and fluctuations in population, volunteers are stretched and worn out. This creates a large hole in the capacity of these communities to invest in thriving landscapes' (Southern Queensland Landscapes 2022, p. 33). The extent to which land sector carbon abatement activities can be designed to align with and support the regional benefit aspirations and drivers of change identified will influence the role that land restoration can play in supporting just transitions to a low-carbon future in the region.

Discussion

Globally, we are at a critical juncture to plan and implement just transitions to a low-carbon future. Progress towards, as well as the outstanding tasks to reach critical decarbonisation goals has and will continue to call on the rangelands to contribute to carbon abatement. This is the case in Australia where rangelands are being heavily invested in as a potential source of low-cost carbon abatement through land restoration activities (Clean Energy Regulator 2023*b*). In response, some landholders are adopting land sector carbon abatement projects and unlocking diverse benefits, whereas others and surrounding communities are raising concerns about perverse outcomes such as land absenteeism and rural decline (Baumber *et al.* 2020; Jassim *et al.* 2022). Against this backdrop of emerging research highlighting that regional community environmental, social and economic aspirations are pertinent to the adoption and achievement of carbon abatement goals (Baumber *et al.* 2022; Curry *et al.* 2022; Jassim *et al.* 2022), we show an approach to understand the aspirations of regional communities and the extent to which land sector carbon abatement projects can deliver on these when provenance (where, how and by whom projects are implemented) is carefully considered. To do this, the provenance of land restoration co-benefits in rangelands assumes a pivotal role in our research. We expand traditional formulations of provenance and, in this broader understanding, provenance becomes a multifaceted means of intervention that encompasses various modes of place-based mobilisation and perspectives, all contributing to facilitating change and realising the desired benefits.

Provenance and co-benefits not only add value to carbon abatement projects but also shape the forms of changes and desired co-benefits within the regional context. By acknowledging the provenance of restoration co-benefits, we bring to the forefront the critical, site-specific needs, interests, and realities. This recognition becomes instrumental in enabling land restoration transitions, where equity and justice are paramount considerations in the process of fostering community engagement and equitable benefit distribution.

We build on existing research concerned with regional response to land sector carbon abatement investments by pairing a socio-economic analysis with a qualitative review of plans from regional community-based organisations to understand their benefit aspirations and the drivers of change they are experiencing to understand how land sector carbon abatement activities can be negotiated to align.

A challenge identified in meeting decarbonisation goals through land sector carbon abatement has been the opportunity costs associated with land management changes for carbon abatement and, typically, how these affect landholders or other businesses, i.e. the extent to which value added (Table 2) could change (e.g. Kingwell 2021). It is arguable that this is a particular challenge in the rangelands where people are often relatively poor and marginalised (Reid *et al.* 2014; Le Tourneau 2020). Pathways to achieve global decarbonisation goals highlight how climate finance must be made affordable, available and accessible to help overcome this challenge of opportunity costs (Al Jaber 2023). In particular, the insights that we were able to collate from a review of regional plans highlight the potential opportunity costs to communities if carbon abatement projects are not able to support critical community outcomes of interest. Traditionally, these social opportunity costs have received less attention in determining the cost of abatement and therefore financing abatement. Financing land management changes for carbon abatement will need to consider the private opportunity costs to landholders *and* social opportunity costs, including potential perverse social or economic impacts for regional communities. Programs such as the LRF that are bundling carbon abatement with environmental and social co-benefits could generate useful lessons for scaling finance to support just decarbonisation efforts. Recognising the potential social opportunity costs of land sector carbon abatement projects can also offer insights to support fast-tracking decarbonisation with contributions from the land sector. Whereas capacity, financial incentives and available technologies can influence landholders' decisions to engage in land sector carbon abatement, so too can their community. The supply of carbon abatement from the land sector can be moderated by communities surrounding landholders on the basis of their (perceived) social opportunity costs or access to co-benefits. Mechanisms, such as bundling of co-benefits, to recognise the provenance of land sector carbon abatement (where, when, and how it was produced) and associated impacts (co-benefits and disbenefits) could support efforts to align the supply of carbon abatement with demand for carbon abatement and thus fast-track decarbonisation.

The analysis presented in this piece is also further evidence that we need to put people, lives and livelihoods at

the heart of climate action and include diverse voices in this effort (as per Al Jaber 2023). Rangeland community plans describe aspirations for the process towards, as well as the outcomes communities associate with just transitions. Creating jobs and supporting local businesses across sectors, while maintaining community vibrancy were critical in the plans reviewed. and sector carbon abatement projects can support just land restoration transitions if negotiated and implemented accounting for regional aspirations in project decisions, governance, and benefit sharing. Further, although there were consistencies in some benefit aspirations (e.g. local jobs), there were different drivers supporting and moderating the achievement of these aspirations across sectors and places for which plans were reviewed. This includes the extent to which different sectors and communities viewed land sector carbon abatement projects as a vehicle for future economic or job opportunities or perverse outcomes (e.g. Queensland Reconstruction Authority 2022). Including diverse voices from remote regional plans can help inform the implementation of carbon abatement projects that align and generate shared benefits for just transitions.

Before land sector carbon abatement can be assessed as a pathway or part of a pathway to decarbonise and support regional just transitions, data are needed on how local communities can expect to experience spill over benefits. For example, it is not clear whether the shift to more or different types of carbon abatement projects in a region could support regional aspirations for local jobs, as articulated in the analysed local government, NRM and First Nations plans. It is also not clear how carbon abatement projects could shift the nature of jobs in the region, such as, for example, change skills in demand (a key driver of change noted in the analysed plans), or introduce more absentee landholders and reduce local populations with cascading impacts for service delivery and employment opportunities (noted as a concern in plans from the remote western rangelands area of the case study region). The socio-economic analysis of the region that we paired with the plan reviews offers the context in which data gaps will need to be filled to answer these questions. The need to navigate these data gaps and make adaptive decisions regarding the role of land sector carbon abatement projects was highlighted in the reviewed plans as critical for the case study region in their pursuit of resilient communities and economies (Queensland Reconstruction Authority 2022).

Our localised case study was of a region highly specialised in the agriculture, forestry, and fishing industry. This context raises questions about the extent to which this could be an indicator of existing skills and knowledge to adopt land sector carbon abatement projects or indicate a vulnerability with the entry of widespread carbon abatement projects. The economic geography of the region indicates that natural resource-dependent industries are important drivers of economic activity, community vibrancy, and growth in the case study region, as well as Queensland more broadly. It has been noted that Queensland, Australia, has regions that are economically vulnerable to transitioning out of coal (Fleming-Muñoz *et al.* 2020) and others reliant on landscapes and natural capital, which also require transition pathways (Green and Gambhir 2020; Nguyen-Trung *et al.* 2022).

Analysing the plans describing benefit aspirations and drivers of change in the case study region highlighted commonalities as well as differences across sectors and places. While the LRF in Queensland, Australia, is investing in carbon abatement and place-based co-benefits that align with regional transitions and aspirations, it is an opportune moment to extract lessons for implementing such models at scale. Although options exist to align land sector carbon abatement projects to support regional community goals, for example, by supporting co-benefits, more could be done to support the alignment of carbon abatement projects with nuanced and regional goals across scales (Daum *et al.* 2023). Contracts and mechanisms to incentivise carbon abatement projects that involve different roles and players to support social co-benefits to manifest in regional communities will be critical for just transitions and continued supply of carbon abatement (Sattler *et al.* 2023). Further, mechanisms to support the valuation of carbon abatement as a product of the provenance of and co-benefits associated with the abatement will require a transfer of incentives to providers that can verify provenance and co-benefits. Although this verification can be challenging, the size of the decarbonisation task and the need to put people and nature at the centre of the effort (Al Jaber 2023), as well as the value of social and economic outcomes expressed by regions warrants exploration of the social benefits and social opportunity costs of carbon abatement projects and close examination of programs that are incentivising bundled co-benefits such as the LRF in Queensland Australia. Future research that explores whether and how regional organisations could verify the co-benefits delivered by carbon abatement projects could also prove fruitful.

Conclusions

Alignment with regional sustainable development agendas, such as enabling just transitions, has been identified as critical for land sector carbon abatement project adoption. The Southern Queensland Landscapes NRM region, Australia, offers an example of where a maturing market for land sector carbon abatement has manifested with communities that have both protested wide-spread carbon abatement activities and communities that have produced boutique carbon plus co-benefits offerings to the market. The analysis presented supports consideration of place-based community-benefit aspirations and drivers of change across sectors and regional communities as well as impacts to local economic, skills and social benefits in decisions to design and invest in land sector carbon abatement. It does

this by showing that, in some cases, the co-benefits of carbon abatement projects could be more valuable than the carbon abatement or payments for carbon. The mixed-methods socio-economic analysis and plan review approach underpinning the study also offers a means to understand community perspectives in remote regions where these insights can be difficult to collate. It is argued that this approach could be applicable beyond the case study region, and used to understand the alignment (or not) of regional aspiration and transitions in other contexts and for other natural-resource management reforms, such as, for example, land management change for erosion or water-quality improvements. The approach could be especially transferable to programs that, like the LRF, are underpinned by a sustainable-livelihoods approach, and most readily transferable to REDD+ projects that are verified by the Climate Community & Biodiversity Standards, from which the LRF Co-benefits Standard draws parallels. The analysis is a stepping stone towards realising the extent that land sector carbon abatement activities can support global decarbonisation goals when potential regional impacts are considered. This research also calls for mechanisms that consider co-benefits and provenance of land sector carbon abatement projects when calling on diverse regional communities and the land sector to meet decarbonisation goals.

Supplementary material

Supplementary material is available online.

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Author affiliations

[A]CSIRO Agriculture and Food Business Unit, Black Mountain, Canberra, ACT 2601, Australia.

[B]CSIRO Environment Business Unit, Ecosciences Precinct, Boggo Road, Brisbane, Qld 4102, Australia.

[C]Northern Institute, Charles Darwin University, Darwin, NT 0909, Australia.

[D]CSIRO Agriculture and Food Business Unit, Queensland BioSciences Precinct, Carmody Road, Brisbane, Qld 4067, Australia.

[E]CSIRO Environment Business Unit, Black Mountain, Canberra, ACT 2601, Australia.

[F]Present Address: Centre for Global Food and Resources, School of Economics and Public Policy, The University of Adelaide, 10 Pulteney Street, Adelaide, SA 5005, Australia.