

# Carbon and ecosystem service markets in rangelands and grazing systems are a wicked problem: multi-stakeholder partnership or roundtable as a vehicle forward?

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## ABSTRACT

Although the concepts of carbon and ecosystem service markets gained traction in the literature in the early 1990s, they have only recently (since the early 2000s) become a reality in Australia. The past decade has seen the appearance of markets for carbon sequestration (and avoiding land-clearing), most of which have occurred in rangeland environments. There has been research in recent decades focusing on the barriers and opportunities for the uptake of such carbon and ecosystem service markets at the landholder level. However, there is limited research into how the policy, institutional and governance arrangements may be affecting the effective and efficient development of cohesive carbon and ecosystem service markets in the Australian rangelands that could result in genuine and enduring environmental, social and community outcomes. Using in-depth interviews with 34 diverse stakeholders, we identified many inter-related themes that provided clear insight into aspects of these markets in Australia. Complexity was the most prominent and overarching theme. The markets operate on multiple levels across state, national and international jurisdictions, leading to confusion for landholders and other stakeholders. The type and number of groups and stakeholders in these systems add to the perceived complexity, with convoluted lines of responsibility, jurisdictional appropriateness, regulation, financial investment, and oversight. There is currently a lack of transparency within these markets, resulting in reduced trust and engagement. We deduce that carbon and ecosystem services markets are, in fact, a wicked policy problem, but have not yet been framed as such. We suggest a multi-stakeholder partnership or roundtable approach be used to tackle the symptoms of the wicked problem associated with carbon and eco-system service markets, which may help in reducing some of the complexities, perverse outcomes and stakeholder trust issues identified in this research.

**Keywords:** biodiversity, carbon farming, climate change, environmental policy, land use policy, rangelands management, sequestration, soil carbon.

## Introduction

In response to declining biodiversity and climate change, governments, non-government organisations and the private sectors have implemented diverse initiatives and policies. One area that has gained traction in recent decades is the development and enabling of various ecosystem service markets, including carbon markets that incentivise agro-ecological practices that avoid greenhouse-gas (GHG) emissions, or increase GHG sequestration in woody biomass and soils (Wunder 2015). These carbon and ecosystem service markets are referred to using a variety of terms, for example, environmental service markets and programs, ecosystem service payments or finance. This paper refers to the general and inclusive notion of both 'carbon and ecosystem services markets' as a whole. Many of these policy interventions, especially in Australia, have frequently affected regions that are primarily dedicated to livestock grazing such as rangelands (Witt *et al.* 2011; Baumber *et al.* 2020).

Collection: Carbon and environmental service markets

Traditional markets for agricultural commodities such as livestock may not reward land-management practices that can protect and maintain ecosystem services (Gerowitt *et al.* 2003). For example, many situations exist where historical overgrazing or excessive land clearing has led to significant biodiversity and environmental decline (Steinfeld *et al.* 2006). For many decades, there has been a call to both value and reward, or at least compensate, landholders and land managers for the protection or restoration of non-market ecosystem services (Gerowitt *et al.* 2003; Jack *et al.* 2008).

Over the past decade, several countries including Australia have developed legislative mechanisms to enable the sequestration of carbon into vegetation and soils (Jack *et al.* 2008; Ramseur 2010; Macintosh and Waugh 2012). The vast majority of these carbon sequestration projects, sometimes referred to as carbon farming, have been implemented in the Australian rangelands (Jassim *et al.* 2022).

The recognition of ecosystem services and attempts at valuing them date back several decades (Costanza *et al.* 1997; Daily *et al.* 2000). However, it should be noted that payment for ecosystem services is not without significant criticisms and concerns (Kosoy and Corbera 2010). For example, the spread of neoliberal approaches to solve numerous environmental problems has come under scrutiny (Cheshire and Lawrence 2005; Lockie 2013). Many of these efforts, such as ecosystem service markets, which were considered as a solution for mitigating trade-offs from livestock production, have instead created a larger-scale problem (Wegner 2016; Roche *et al.* 2021). Despite significant academic and research interest in measuring and valuing ecosystem services provided by both natural and semi-natural landscapes (such as most rangelands), it is only in within the past two decades that government policies and legislation have formalised these markets (for example, the Commonwealth Emission Reduction Fund, and in Queensland the Land Restoration Fund) (Baumber *et al.* 2020).

Carbon and ecosystem service markets have disproportionately affected grazing lands and rangelands compared with other forms of land use. The implementation of these policies has not gone without academic and media scrutiny about their adequacy and potential unintended social, economic and environmental impacts (van Oosterzee 2012; Keenan *et al.* 2019; Jassim *et al.* 2022). Furthermore, speculation over the capacity for these policies, especially in the rangelands, to deliver the expected levels of carbon sequestration, given the financial investment, has contributed to the recent call for independent panel review of Australian Carbon Credit Units (Nerlich and Koteyko 2010; Chubb *et al.* 2022). There has also been some concern about flow-on impacts to the communities where these projects are being undertaken (Baumber *et al.* 2022; Jassim *et al.* 2022). Apart from these carbon sequestration concerns, emerging ecosystem services markets such as those relating to biodiversity raise questions about how to adequately measure and quantify

different types of environmental attributes. Concerns exist that these market mechanisms may reward past poor environmental performance and provide no benefit for landholders or regions where environments have traditionally been well managed (Engel 2016; Karsenty *et al.* 2017). A specific concern in this area is where past land management policy and practices have led to broadscale clearing of native vegetation, resulting in significant economic benefit but environmental impacts. This perverse situation allows landholders who may have historically cleared land to disproportionately gain from future carbon or ecosystem service markets compared with those who did not clear to such an extent (Gordon *et al.* 2015).

In addition to the range of concerns outlined above, it is not well understood how landholders and land managers are engaging with these policies and programs. A considerable body of research over the past two to three decades has attempted to describe the barriers and opportunities for the uptake of such carbon and ecosystem service markets at the landholder level (Fairbrother 2017; Evans 2018; Moser *et al.* 2022). For example, policy uncertainty, fear of long-term commitment and distrust of government are common reasons why landholders may resist engaging with ecosystem service programs, whether for carbon, biodiversity or other environmental outcomes (Dare *et al.* 2012; Fleming *et al.* 2019).

Because these market-based policy instruments, which relate to rangeland grazing systems in Australia, are relatively new, their adequacy has received relatively limited research (Knight and Knox-Hayes 2015). Although there has been research into aspects of the concerns and issues raised above, there has been no research that attempts to take an overarching and holistic view of the situation of carbon and ecosystem service markets as they relate to the rangelands and extensively grazed ecosystems of Australia. Therefore, this project draws on in-depth interviews with diverse experts and key stakeholders to identify the policy, governance, and institutional barriers and opportunities for current and emerging ecosystem service markets that have the potential to be applied in extensive grazing land systems in Australia.

## Methods

### Overview

Exploring how people understand and interact with any issue or circumstance is often best approached drawing on qualitative and interpretivist methodology that allows meaning to be deduced inductively from the data, as opposed to collecting and analysing the data through a pre-designed framework (Creswell 2003; Hay 2005). This research drew on 34 in-depth interviews with experts and key stakeholders, representing diverse perspectives from

within the Australian context. The focus was on defining the opportunities and barriers surrounding carbon and ecosystem service markets at multiple levels, including both individual and industry, but with primary focus on the policy level (Fleming *et al.* 2019).

The semi-structured interview technique was chosen because it keeps the conversation with participants aligned with the aims of the research, but still allows participants to discuss ideas around the topic, expanding on issues that they believe are relevant, and potentially include unanticipated concepts. Our semi-structured interviews also avoided introducing leading questions and assumptions, and resisted imposing researchers' perspectives onto the participants (Agee 2009). Interview data were transcribed, de-identified and thematically coded in NVivo 12 Pro (Lumivero 2017), to determine the emergent and key concepts from the stakeholders' and participants' perspectives. The study gained ethical approval through The University of Queensland (2021/HE002294).

## Participants and recruitment

Participants were recruited through a combination of known stakeholders of the researchers' network, and a chain-referring or snowballing technique (Biernacki and Waldorf 1981). At the close of each interview, participants were asked to recommend additional interviewees who had different experiential knowledge, or complimentary, or contradictory views to that of their own (Moon *et al.* 2016). Recruitment of additional key-stakeholder and industry representatives through said organisation's website contact pages also occurred to fill any categorised background gaps.

During the recruitment stage, 74 potential participants were contacted (46% engagement rate). The project had a target range of 30–35 interviews. Theme saturation was affirmed after approximately 20 interviews. However, the interviews continued until we reached 34 completed interviews, when it was felt that a broad insight of the issues had been obtained (Hennink *et al.* 2017). Participants were able to provide multi-level and sectorial perspectives because of the multiple roles they held and the wide-ranging backgrounds in which they had experience. This included a range of experts, practitioners and other key stakeholders engaged in the development, planning and implementation of a range of ecosystem service and related policies. The selection criteria for participants were:

- Must be over 18 years of age,
- Had been involved in the development, implementation or evaluation of carbon or other ecosystem service market programs,
- Had been a key stakeholder or informant in the development of such policies where their input has been to provide a particular stakeholder perspective on the development of policy, or

- Had undertaken significant research that provides unique insights into the issue under investigation.

These criteria therefore included researchers, state and national government agency staff (current and past) as well as non-government organisations such as banks, consultancy group, conservation groups, agricultural organisations and natural resource management groups. Although this research did not seek to include landholders as a participant subgroup, there were a number of participants able to provide landholder insights from either their own professional engagements with landholders, or who were themselves landholders, a role they held in addition to their professional role.

We were unable to obtain the perspectives of a national government representative, nor that of an indigenous representative.

## Interviews

The 34 semi-structured interviews occurred between 19 October 2022 and 15 February 2023. The duration of each interview averaged between 45 and 60 min, and all interviews were conducted via Zoom Video Communications Inc. (2016). The Zoom Video Communications Inc. (2016) recording function was used during all interviews, which generated an automatic transcript. This transcript was then reviewed and amended against the original verbal recording. Each written interview produced was a verbatim transcription of the original verbal interview. All participants were de-identified and given an identification number (1–34). Once the de-identified transcripts were reviewed and amended, they were returned to the participants for checking and confirmation to ensure they accurately reflected the participants' views. Eight participants made corrections or clarifications. Such confirmation ensured the credibility of the transcription process (Moon *et al.* 2016).

Interview questions focused on (full interview guide available in Supplementary Material S1):

- The participant's role and experience within the broad sphere of carbon and ecosystem service markets, as they relate to agricultural and/or grazing lands.
- The barriers and opportunities of schemes in the carbon ecosystem services market space.
- Modifications or policy recommendations for improved systems or programs.

## Analysis and interpretation

Analysis was completed through the categorisation of interview responses into thematic codes (Nowell *et al.* 2017). Common themes were identified and coded accordingly. The code development itself was an inductive process and sought to both contextualise the various themes and to

indicate their significance within the overarching aim of the project. Coding consistency was checked and validated. Once the initial data analysis had been conducted, both the themes and the interpretations were re-examined, including literature relevant to the research scope and aims. NVivo was used in the data analysis. All coding was reviewed to look for both hierarchical importance and salience to the key research question to prioritise and organise themes.

## Results

This section reports on the thematic analyses of interviews. The emergent and overarching theme was that of complexity. Eight interlinked key themes within the enveloping concept of complexity were as follows: transparency, consolidation, support, jurisdiction, integrity, barriers, nature and biodiversity markets, and policy. Within each of these categories, additional subthemes emerged from the 34 in-depth interviews, and 48 key and subthemes were identified (see Supplementary Material S1 for full list of identified themes).

### Complexity

Complexity was noted in every interview and sits as the overarching theme. The comments on complexity address the convoluted and multifaceted nature of both the carbon and ecosystem service markets, as well as addressing the pressure to include additional ecosystem services within an expanded system. Participants were invited to comment on the nature of both carbon and ecosystem service markets. The results reflect a greater carbon market focus from participants; however, this was due to the carbon market being used in most cases as a comparator, because it pre-dates ecosystem service markets.

These market structures are particularly complex in the Australian context because of property size, farm-scale variability, ecosystem diversity, and climate unpredictability. Australia is an export-oriented country, so there is also the need to align these markets, including their methods and standards, with those operating internationally. To understand the breadth of the complexities facing these markets, the responses should be considered not only in isolation, but in combination. One participant summed this up by noting that

...these are complex markets that they're trying to design. They are not normal markets. There are multiple issues with them (Participant 27).

Carbon and ecosystem service markets are reliant on participation and contributions by multiple stakeholders. However, on numerous occasions participants identified that the complexities associated with these markets were the main barrier and deterrent to farmer or landholder engagement and participation. Some examples of specific

markets and their related programs mentioned during interviews were as follows: the Land Restoration Fund, The New South Wales Biodiversity and Conservation Trust, Carbon + Biodiversity Pilot, Emissions Reduction Fund and Accounting for Nature. Specific complexities highlighted were the jargonistic contracts, the convoluted compliance requirements, and the lack of clear and relevant examples. The information that was essential for participation, was frequently beyond the expertise and experience-base of landholders, leaving it incomprehensible or misunderstood. Thus, landholders resorted to using external services (high cost, non-regulated, non-assured pool of intermediaries or carbon service providers) to facilitate their entry requirements. This was, in some circumstances, disconnected from the programs, which were designed to work directly, and only, with landholders, leaving the farmer either disengaged or set up for failure.

Landholders were at a high risk of non-compliance through a lack of understanding of requirements and how these markets work (as described above). Compliance was noted to come at a high cost, and when the requirements of compliance are not fully understood by landholders, this resulted in poor initial planning and budgeting (prerequisites for such schemes and which dictated reimbursements), rendering landholders unable to fulfil their contractual obligations.

... the actual understanding about the different trade-offs in terms of the environmental benefits were really poorly understood... But then I think there's this interaction with having contracts that land holders seem a bit ambiguous about – what I can and can't do? And how does that impact that output at the end? (Participant 11)

According to some participants, limited consideration was given to the (high) risk of environmental fluctuations (drought, flood, fire, El Niño/La Niña), and how that might influence compliance outcomes. Many current contracts were long-term (25 years), exacerbating risk. Therefore, participants felt that there was a need to change the way the payment mechanisms operated in terms of time frames and payment types, to reflect these risk realities.

Such complicated systems require formal regulation, direction and support. A related node identified was the issue of jurisdictional appropriateness of market regulation, and whether governments (local, state or federal) or if it should be in the hands of industry, independent bodies or supply chains. Some participants questioned who (individual or a combination of entities) should be setting the standards by which all had to abide, and who should ensure that standards were met? One participant, highlighting the lack of clarity of who is best placed, commented as follows:

I think it's a combination of industry and Federal Government, and I'm not sure to what extent the states



need to play. I mean the states have been playing into this in the absence of the Coalition<sup>1</sup> taking it on basically. You've seen the State step in because they got the shit's waiting for the Feds. (Participant 10).

The participants had differing perspectives on the need for either a regulatory market or a voluntary market, and who or how these should be overseen. Many participants recognised both the need and appropriateness for government roles within these systems. However, there was no clear consensus as to which level of government, and what form such a role should take. Despite the recognition of the need for government to play a role within these markets, the 'nature of politics' (Participant 17) was seen to be a barrier to market growth, participation and perception. The need to avoid the alignment of these programs with political election cycles was also noted by some participants.

Participants indicated that these markets would neither function appropriately nor grow without consistent and substantial financial backing. Participants raised concerns over which stakeholder was responsible for meeting these financial requirements, and how that money should be fed into the system. Although there was no clear consensus, examples were shared where funding for landholders engaged in carbon projects had been provided in lump sum upfront payments, such as those funded through the Emission Reduction Fund, Commonwealth funding mechanism. However, there was consensus that funding should reflect both the contracting, and the nature of what was being performed (long-term biodiversity protection or carbon banking). If there was a 25-year contract, then funding should be aligned with markers along that life cycle, and that grants or one-time payments were particularly noted as being unsuitable for long-term impact. Some participants felt that the private sector had a greater funding pool than did governments, and therefore should be responsible for providing private finance because government did not have adequate funding to support these markets. However, it was acknowledged that it would be necessary for government to act as guarantor for market funding in the short term (for example, providing start-up funding for project initiation, as well as acting as a purchaser or credits for example), with longer-term plans in place for this to cease, as markets gained in depth and maturity. The interviews showed a view that initially government would be required to play the role of driver, supporter and guarantor of these markets and their initiatives. The quotation below highlights the complicated relationship and role of governments within these systems as they set the policies but do not have an ongoing hand in their functioning.

It needs to be taken out of the political cycle. So there's a role for government here in setting an independent

statutory authority, that has the power to drive carbon price within a set of standards. And setting those long term emissions reduction trajectories to 2050, that's 10–15 governments away. And the natural tendency of government is to leave the hard work to the next generation. In terms of longevity of markets, governments set the policies and the institutions in place and get the hell out of the way. (Participant 31).

Several participants indicated that some stakeholders view the system as both divided and sectional, and that it was neither linking nor communicating for a shared beneficial outcome. An example of lack of coordination among government departments is illustrated as follows:

We got one side of government that doesn't know what the other side of government is doing. It's the Ministry of Transport it's signed it up, while we've got the department of Climate Change is saying to tidy up and revoke it, etc. (Participant 14).

Stakeholders were seen as either working in isolation or competing against one another. Participants commented on the need to consolidate to assist in managing some of the complexity. Consolidating the current competing efforts through a more 'universal system with greater conformity of the market around that' was suggested (Participant 2). This could be implemented in several areas, such as linking the carbon and biodiversity markets, or consolidation of the various States' funding schemes, programs and initiatives. There were clear calls for a more nationally driven approach. This was described by one participant as follows:

You need to have an approach that's applicable, not just in one region or one State, but from either a Commonwealth level or from a private enterprise that covers all of Australia. I think operating various programs in silos, that we're not going to see a long-term success. (Participant 16).

The sheer volume of 'un-consolidated' options being described as 'analysis paralysis' (Participant 1) to engage in these markets, has resulted in additional disengagement at the landholder and farmer level. This sense of fragmentation has also been reflected in the associated technology and data-collection space. The isolation of markets and their lack of coordination have resulted in a flood of collection requirements that exclude sharing of information among programs.

## Transparency

The vast majority of participants discussed issues of transparency, or its lack, which was considered another key

<sup>1</sup>The conservative aligned political Coalition had been in government at the national level for just over 10 years and had been replaced by Labour earlier in the year that interviews were undertaken for this study.

emergent theme. Discussions held around transparency showed a notable undertone of anger and frustration from some participants because of participant disappointment and a sense that the limited transparency, predominately from government, was both unnecessary and harmful. All stakeholders sought transparency within the system, but many reported the lack of transparency as being a significant issue for them. Participants agreed that successful markets demand transparency, particularly with respect to responsibilities, payments, and expectations.

But no one's actually getting in there, and demystifying it, clearing the smoke out of the room and saying, with those case studies, this is all you need to be doing right now. (Participant 31).

Associated with the issue of transparency was the perceived need for increased levels of collaboration and discussion for all stakeholders throughout all stages of a market development, especially for those whom these markets may affect, such as indigenous Australians. This also included inviting needed expertise where appropriate and acknowledging that the complex nature of these markets required multi-disciplinary knowledge to move towards a well-informed, targeted, and transparent system.

[Government] Departments need to stop pretending that they know everything... they need to bring external advice, again in a transparent way. (Participant 27).

The need to identify the appropriate role of actors for this consolidated system was highlighted by several participants. Concerns were raised around who were the *right* actors, and how the *wrong* actors could hinder uptake or affect trust and perception. As articulated by one participant,

...[landholders] tend to be a bit more skeptical about government involvement. I grew up in ... the Australian tradition, where we were very skeptical of governments and banks, and those sorts of people... it was just a real spirit of distrust for them... we know you guys have a necessary role and function, but don't try and sell us something, we'll see through it if it's something that's not based on some level of integrity. (Participant 2).

There were issues surrounding trust and the perception of various stakeholder groups, as well as potential conflicts-of-interest regarding why specific bodies should not hold certain positions. There was also commentary on the necessity for trust and integrity to be prioritised within the overall system, to ensure market viability in the long term. Also of note was the lack of trust and the associated risk of either perceived or real greenwashing (as defined by Laufer (2003) as forms of misleading information from organisations and agencies attempting to alter public reputations or shape public

perceptions), which was increasing perceptions of risk to projects and hampering engagement. These trust and perceived integrity issues have evolved over time. Reputations and the historic effort of potential groups of stakeholders have influenced how the markets and programs are currently perceived.

You really are otherwise selling fairy dust. Without trust your market has problems. So that's a theme that I think, is relevant across all of these markets, as to whether they succeed or not. And it's not even actual integrity issues often. Just the perception of them can be enough, as you will have seen in carbon recently. It's caused quite a kerfuffle where, what I would say are unsubstantiated claims, get airtime, and it undermines market confidence (Participant 29).

A key component of trust and integrity was a concern about intermediary actors in these markets (also known as carbon service providers or carbon brokers). Participants spoke to the rapid emergence of these actors, and how they were frequently viewed as untrustworthy ('...selling snake oil' (Participant 30)) due to the lack of regulation and quality assurance surrounding their services.

There was no disputing the necessity for this type of role (carbon service providers) to facilitate navigation of these complex markets, but it was suggested that the role needs to be re-assessed. This led to the discussion, echoed by several participants, that a new role needed to be created for a specialised intermediary person, one with the skills and education to successfully provide advice and navigate these markets and systems. Alternatively, it was considered that this role could be undertaken by leveraging off the existing relationship and trust in Natural Resource Management (NRM) or extension (advisory) officers, by up-skilling and targeted training of these professionals.

Participants frequently discussed issues of data. The first, related to the concepts of trust and transparency, was strongly tied to a perceived lack of data visibility, a source of great frustration for some participants. It was noted that significant publicly funded research and data gathering had been undertaken, but had not been made available. This was seen as a missed opportunity to build confidence, trust and transparency, and was acknowledged as hindering the market development. It was said in many interviews, that by allowing access to the data, confidence and trust would be built up in the system, allowing participants to understand the system better through the use of verified examples. There would be indications of 'what had occurred where', and 'what had-or-had-not worked previously' (in terms of methodology). Data visibility would then assist in both the consolidation of the system and help reduce duplicate or wasted efforts. Many participants held very strong views on this lack of transparency and availability of the data, as expressed by Participant 33,

It's one thing not having the data. It's another thing, not knowing where to get it! Find a way. They need... a bucket of money... to actually make some of this stuff available, because this is a problem. And two things happen if you do that. You get confidence across the sector, but you also find a whole bunch of data sets that make those existing schemes more robust by allowing that data to go down to them. So they don't have to go inside the farm gate (Participant 33).

The paucity of 'on ground' data was frequently identified during interviews as a hindrance to the ability of the markets to mature. There was agreement from several participants that data and baselines were needed to make informed decisions about the landscape, as well as to mitigate against investment and compliance risks.

What we are hoping will happen is that as people go out and build more environmental accounts. And those who do have the funding to actually identify reference benchmarks in their region, would be happy to share this into a public library, so we can start building a free-to-access data set that other landholders can use. But that is a really slow process. And before we have data for all of Australia, we're talking years or decades (Participant 16).

Therefore, there was a need for the system to actively support large-scale data collection and its subsequent access, to aid in the development of these markets.

## Policy implications

There were over 30 references regarding specific policy and regulation needs and recommendations throughout the data because the current policy setting is not regarded as sufficient, and is described as follows:

I'd say we've had extremely fragmented developments in different bits of the system on an issue driven basis... So we haven't had, a bigger policy conversational dialogue about how we would actually establish a genuine ecosystem service-based economy. (Participant 6).

Because of the varied nature of the recommendations, they cannot be covered individually here. However, there was significant recognition by some of those interviewed of the need for additional regulation to help manage the complexity of, or participation in, the system. The consensus was that there was a need for more directed and aligned policy and regulation, including aligning with market signals, that would assist in the successful, continued development of these markets.

The domestic policy situation is about providing the integrity and coordination of the various schemes (Participant 23).

Some participants felt that there was a need for better thought-out, practical policies and regulations, because current policies and regulations were thought to be acting as impediments to development. Some policies and regulations were also believed to be misdirected or poorly designed and implemented. There were several examples from participants, with one describing working in an echo chamber resulting in the loss of potential for 'on-ground' gain.

The disconnect and the misalignment of the narrative and the reality, is a real problem. And I think that could be getting in the way of policy responses. What Echo chamber are we in here? Because it's not what's happening on the ground. (Participant 28).

'Policy verses quality' (Participant 31) referred to the idea that too much policy or regulation could be as harmful as too little, and that inappropriate policy or regulation would act as a deterrent to participation. One participant spoke to current policies and said that they were focused on lowest-cost abatement, and skewed investment to current commercially available at-scale technologies and practices.

I have some fundamental issues with the policy that has been designed to de-carbonise Australia. ... it doesn't support innovation. (Participant 10).

## Market maturity

Participants also spoke to the general nature of the development of biodiversity and nature markets (both Commonwealth regulatory and compliance markets, and non-state market-led environmental governance models, such as nature credits by the GreenCollar organisation). Some participants indicated that it has taken a long time for governments to develop effective carbon-related mechanisms, and there was a concern that it should not take as long to learn the lessons for the more recent and emerging biodiversity markets. Comments were made regarding the need for parallels to be drawn, as well as for more reflection and feedback between the two markets. Some considered that lessons from the carbon markets could and should inform biodiversity markets to aid their growth and development. A common issue with the markets was with the methods and measurements systems being used, and their misalignment with common farming practices. There was also the call to allow more time for the results of certain actions to be realised and learnt from, including the biophysical systems responding to policy settings.

Many participants commented on what had been driving the changes to these markets. It was recognised that there had been a notable public perception and ideology shift towards a more 'green ideology', where consumers are demanding to know the origin of their products and how they were produced. These shifts in perception had led to increased demands and had created expectations of

responses by both the market and investors. These trends have increased demand for ecosystem services, and for the ability of industry to demonstrate a contribution to these markets, as well as being the driver of access to international markets. Discussions were also had on landholder drivers, such as community perceptions or pressures as to whether they would engage in these markets. It was noted that better placed incentives and targets would be needed to drive growth of these markets.

The stifling of market progress by the demand for perfection was another emergent theme. It was noted that for many methodologies and policies, the desire for them to be perfect before implementing them 'on ground', could result in a lack of any progress at all.

We have to acknowledge that it's going to be wrong on day one. We get stuck in the Australian policy discourse about putting perfect in front of good. I'm not going to do anything until it's perfectly right (Participant 31).

There were various views around the nexus of perfect science and progress, and what would provide the better outcome.

They were getting so hung up with accuracy of soil carbon measurement and methodology that it's stopping any progress. Show me a market that has perfect accuracy... People need to give and take a bit to make progress here, and we need to give a bit of all that latitude on materiality for the sake of just getting things rolling (Participant 10).

In terms of assisting the development of the markets, there were numerous recommendations for the concept of 'sand-pitting' or of testing out potential ideas in a way, or in a space, that is safe and encourages innovation. Linked to this idea was the need to help, support, drive, and reward innovation. As described in the following:

.... don't stifle innovation. And think about how you do things, and test them somehow, and maybe it's the sand-pit? Don't expect everyone's going to take a thing right through the methodology, without having any confidence whether it actually means anything in the landscape (Participant 33).

There were many comments on the relationship between integrity and cost, and how to get the balance right. How much should integrity cost, and 'what was the market willing to pay for it?' (Participants 2, 10, 15). There were several comments around the misalignment of the cost and integrity relationship. What level of integrity was needed to allow the market to work effectively, especially considering the correlation between high integrity and high cost? There were expectations of how cost (time and money) was

(or should be) reflected in the integrity of a system (how good, strong or sustainable it was).

A lot of the time, I think it takes a couple of goes before you get something that strikes the right kind of balance between complexity and rigour and certainty. (Participant 1).

## Methodology and crediting

Issues with current methodologies and the need for their development was a code with one of highest number of comments. The current state of methodology was viewed as being neither practical nor applicable on-ground by farmers. Some participants questioned whether the science behind the methods lent itself to on-farm usability and what were the clear linkages to the market drivers.

There's a chest full of scientific methods for carbon markets in Australia; carbon farming methodologies. The problem is, they're not connected with a market driver or market need that enables uptake. The pain point was lots of methods, lots of blueprints telling people how to do things, written by well-intended scientists, but poor up-take (Participant 10).

There was a call to consolidate and coordinate the methods underpinning carbon and biodiversity methods. Currently what may be a measure under a carbon method, could be contradictory for a biodiversity outcome and vice versa.

... where we might see improvements in endangered species, might not necessarily be where we see where we get the best carbon outcomes. So those things don't necessarily always package together... (Participant 11).

Another point raised with current methodologies was the noted success and desire for greater recognition for method stacking, which is described by the Carbon Market Institute's Landscape Taskforce, as the employment of multiple carbon-abatement methods across a single property, to maximise potential while minimising necessary administrative. This has been seen in the latest investment round of the Land Restoration Fund. Method stacking was seen as a way to reduce costs and add value. Along with the comments pertaining to methodology, were comments to do with the need 'to invest in the rigour, to give it accountability' (Participant 4).

There was a similar balance and debate around what level of rigour was needed to run in parallel with the various methodologies, and how that would be reflected in the time and finance inputs needed to achieve it. There is a commonly held perception that entering, and then complying with, these markets came with a high cost to the landholder.



This needed to be considered when trying to balance the rigour/cost equation associated with each of the methods.

... one of the issues is of getting functionality and standards happening that are actually underpinned by good science; that we're actually accrediting genuine ecosystem services. (Participant 2).

There were also many comments on the current state of crediting. There was a perceived need among several participants to increase crediting options as well to broaden the range of acceptable methodologies used to support the credit system. There was also seen to be a need to transition to an outcome-focused system, instead of the current measurement-focused one. This was described in the following way:

...a lot of them are trying to measure or certify actions rather than outcomes and real impact on the environment (Participant 16).

The other notable issue around crediting was the concept of additionality. There were divided views on the definition, and the appropriateness of additionality. The idea of rewarding poor past-behaviours, and not recognising those who had been practicing historically sound management techniques, was considered both unfair and in many ways counterintuitive to the ultimate goal, which is for greater ecosystem preservation.

We've locked up land and have looked after it for 30 years. But nobody's giving us a carbon credit, so very conscious of that (Participant 18).

Opinions were divided on the appropriateness of additionally, and in- and off-setting. This added to the

uncertainty and complexity of current programs, and the mixed messages about them. The overall sense was that there was still a level of uncertainty on how to factor these in, and the impacts they could have on both the market and participation levels should they be incorporated into the overall system.

## Additional results

This section has covered the overarching themes from the analyses. It is important to note that there were other themes that did not have sufficient weight or nuance in the data to be covered as standalone discussion, but that did underpin the larger, overarching themes outlined above. Many of these themes already have a heavy body of literature behind them, which were supported by our data (see below Table 1). Despite the cynicism felt and depicted within the data, it should be noted that, overall, there was an optimistic view from participants on the development and state of these markets. This is important to note as it speaks of the willingness from the varied stakeholders to continue engaging in these markets. A number of successful attributes were discussed by the participants in the study, including the following:

- The need for assurance in terms of longevity of programs, contracts and funding, which is detailed in the Complexity section of the results.
- That programs and payment should also acknowledge, and reward for co-benefits (which is a benefit beyond avoiding the emissions of greenhouse gases).
- The incorporation of the stacking of Australian Carbon Credit Units (ACCUs) into schemes and programs. Which is being recognised for adopting a number of potentially overlapping carbon-farming methods.

**Table 1.** Additional themes identified from within the sample data, with theme description (full coding framework available in Supplementary Table S1. Coding matrix).

Theme	Description
Farm scale	The size of a property affects the appropriateness or eligibility to partake in markets, payment mechanisms and programs.
Risks	The risk associated with engaging in these markets. Concurrently, how engagements in these markets de-risk farm business through income variation.
Suggested future alternatives	Specific suggestions regarding future changes to markets or its programs.
Community engagement approach	Working with whole communities as a way of achieving greater impact, or for combating small farm-scale compliance issues.
Acknowledgement of reviews and monitoring	The need to look to and acknowledge past work to inform future decisions.
Chubb's review references	Comments pertaining specifically to the 2022 <i>Independent Review of Australian Carbon Credit Units</i> .
Environmental service market not a panacea	Not everything should be classified as an ecosystem service. These markets might not provide all solutions to the diversity of environmental problems in grazing lands.
Technology	Technology as an opportunity to aid in market development, or with access to markets.
Modelling versus measurement and hybrid	The appropriateness and debate among modelling, measurement, and hybrid methodology.

- Schemes need to be designed to reward for outcomes or improvements, rather than simply applying methods or inputs, to guarantee positive change.
- The need for free-flowing consent and transparency, which is detailed in the Transparency section of the Results.

## Discussion

Given the significant concerns for environmental decline and climate change, ecosystem service payments and other financial instruments have been advocated for, and implemented, as one suite of policy measures to address these issues. The relative novelty of this policy direction has meant that there is little published research available on its effectiveness. This study aimed to identify the policy, governance, and institutional barriers and opportunities for current and emerging ecosystem service markets that have the potential to be applied in extensive grazing-land systems in Australia.

The policy and regulatory environment in Australia appears plagued by a range of overarching and interconnected issues, including complexity, limited transparency and questions over the appropriate roles and jurisdiction of different levels of government and non-government actors. It is recognised that carbon and ecosystem-service markets need to operate at a scale to create sufficient market depth to be viable long term (Keenan *et al.* 2019; Reed *et al.* 2022). This supports the call for national rather than regional market bodies, and for alignment with international standards. However, large markets come at a cost, namely, regional specificity and expertise may not fit larger markets, and both risk and complexity increase. Our data showed that current markets and schemes are perceived as being both overwhelmingly complex and lacking in transparency. This situation is associated with the corresponding perceived symptoms of a lack of trust and integrity issues, which act as barriers operating within that space, as well as eroding public and stakeholder confidence (Dhanda and Murphy 2011).

These symptoms are reflected in the recent call for the 'Independent Review of Australian Carbon Credit Units' (Chubb *et al.* 2022). Chubb *et al.* (2022) similarly highlighted, for example, the importance and impact of different perspectives on transparency on the integrity of such schemes, the need to apply knowledge gained through experience, to clearly identify the key roles, remove unnecessary restrictions on data sharing, and acknowledged that this cannot be achieved without adequate resourcing.

Our data showed that carbon and environmental services markets and policy settings in Australia share and reflect many of the attributes that define 'wicked' policy problems (Rittel and Webber 1973; Head 2008; Head and Alford 2015) (see Table 2). The concept of 'wicked' problems,

developed in the 1970s by Rittel and Webber, is now well established as a lens to frame and address social, political and environmental challenges that defy traditional narrow approaches to developing solution.

To some extent, it appears ironic that the utilisation of market mechanisms, which are intended to be a straightforward policy approach to incentivise environmental practices, has led to the creation of a complex and wicked policy environment. Ecosystem service payments are intended to overcome some of the environmental challenges created through agriculture by correcting inappropriate market signals, which do not necessarily reward sustainable environmental practises (Gómez-Baggethun and Muradian 2015). So, although the approach appears relatively straightforward, and should provide a simple solution to encouraging environmental outcomes, the insights from this research have indicated that complexity prevails in relation to these environmental service markets as they relate to Australian rangelands.

From this research, we deduced that these markets should be seen through the lens of wicked problems. Building on the definition above, these are issues that resist being framed within clearly defined boundaries, where causality does not align linearly with effect (knowledge uncertainty), and whose evolution lacks predictable patterns (dynamic complexity). Such problems tend to generate conflicts among the values of stakeholders. They differ fundamentally from 'tame' problems, and require governance approaches encouraging the instantiation of deep and broad systemic change (Dentoni *et al.* 2018).

Therefore, it appears that the issues and challenges of developing and maintaining carbon and ecosystem service markets have not been framed as wicked, and the development of these markets has been seen as narrow and linear within the realms of landholder adoption (in the case of carbon and biodiversity). With carbon, for example, the Australian Federal Government set up Australian Carbon Credit Units and outlined a set of accepted methods and then stepped back, hoping that farmers and landholders would implement them. Carbon was framed as a simple regulation and market-creation problem. This siloed, linear approach, which ignored complex realities, has a history within the Australian context. Too frequently environmental issues have been addressed in isolation. Financial market-based solutions tend to reproduce this narrow approach (Higgins *et al.* 2012; Baldwin *et al.* 2019).

Dealing with the multi-faceted nature of complex wicked problems requires insight and creative deliberation from stakeholders at all levels, which will represent multiple values throughout the system (Dentoni *et al.* 2018). Many of the interviews showed that stakeholders engaged within these markets tended to work in isolation, without the tools to cooperate or combine, to either reduce risk or to increase their chance of a successful outcome. There was no pathway within the formatting of the markets that allowed for

**Table 2.** Modified version of nine attributes of wicked problems, adapted from Australian Public Service Commission (2007), along with key insights from our data.

Wicked problems:	Comments from this study on carbon and ecosystem markets
...are difficult to clearly define.	Difficulty clarifying what the problem is that these markets are intended to address, that satisfies the perspectives of multiple stakeholders. Carbon farming may be seen as an income-diversification strategy.  Different stakeholders all with very different components that are relevant to them. This also is reflected on very different motivations to engage, support or even reject them.  Sits squarely under the major and overarching theme of complexity
...have many interdependencies and are often multi-causal.	This study showed that defining these markets only in terms of a linear 'regulation–market–adoption' issue is inadequate to encompass the multi-dimensionality and interdependent nature of components of the system.  Many programs, but also consequences of each of them, lead to other challenges and behaviours in the system. Carbon projects may lead to negative or even unknown biodiversity outcomes.
...result in unforeseen consequence from solutions.	Unclear what many of the potential perverse environmental, social and economic impacts may be from landholder and enterprise level through local regions and broader biodiversity and atmospheric change. For example, landholders may not remove vegetation that they have legal rights to clear such as Invasive Native Scrubs (INS) areas in Western NSW (NSW Government 2019), to avoid carbon pollution. However, the right to clear is on biodiversity protection grounds. It is unclear what the environmental impacts of that decision are.  Sudden appearance of the carbon service providers, with a level of concern towards their actions and behaviours and the unregulated services they provide.
...are often not stable.	Political changes alone in the space of environment and climate have been volatile over the past two decades and this has created great uncertainty in policy and investment. Discussed often in terms of significant drought, fire, etc. on a volatile climate (especially in rangelands).  Political volatility around historical climate policy in Australia and the need to de-couple these markets from political cycles.
...usually have no clear solution.	When do the payments stop? Questions remain around what is the benchmark for good land management? Do we continue to keep paying people for what would be considered an obligation of land ownership? Linking to the concept of Additionality, of going beyond routine land management.  In south-western Queensland, carbon payments (human-induced regeneration) are going to stop after 25 years, which will create further issues from income-diversification and enterprise-viability perspectives.
...are socially complex.	The conflicts and different views on the merits of these markets are indicative of this. Perception of the programs as being too difficult and too much trouble to engage with for landholders. Some levels of 'jealousy' between those eligible and those ineligible to participate.
...hardly ever sit conveniently within the responsibility of any one organisation.	Explicitly discussed in the data on jurisdictional issues and convoluted lines of responsibilities. The differing roles and actions from various levels of government, and non-government actors, for example, local NRM groups.
...involve changing behaviour.	The need for a whole of system behaviour change, including that of markets, finance, regulation. These issues go beyond landholder adoption and behaviour change.
...are frequently characterised by chronic policy failure	These markets have not existed long enough to know whether chronic policy failure is a characteristic. However, the insights from this study would indicate that without improvements, there is a risk of ongoing problems. One challenge highlighted in the data is the perfection versus progress challenge, or the cost of perfection theme, relating to trust and integrity versus efficiency.

systematic coordination, with the result of repeated duplications of effort and errors, wasted expenditure, missed opportunities and an overall sense of competitiveness among so many of the stakeholders.

Departments need to stop pretending that they know everything... (Participant 27).

What this research suggests is that instead of repeating previous, unsatisfactory practices, a multi-stakeholder partnership or roundtable approach could offer a genuine chance at navigating the complexities of these market

systems (Dentoni *et al.* 2018). Although not without critique (Carmagnac *et al.* 2022), they do show promise regarding the addressing of issues such as have been presented in Table 2.

We suggest that a multi-stakeholder partnership or roundtable be formed, including all relevant stakeholders within these markets, where discussions and on-going exchanges of information and collaboration can manifest. An open communication platform would provide the opportunity to reduce complexity through better coordination and streamlining. Such an approach would also increase transparency among stakeholders, maximise data sharing, and

clarify areas of data needs. Increased data availability, which raised the knowledge base of all stakeholders, and shared data, that reduced siloed efforts and secrecy, would potentially transform the market system, also raising the chances for successful environmental outcomes (Maron *et al.* 2016; Hartmann and Thomas 2020).

Roundtables that incorporate wide-ranging, heterogeneous multi-stakeholder partnerships are designed to optimise for successful outcomes in terms of globally complex, wicked problems. Their combinations of 'diverse expertise and capabilities' are believed to generate innovation and creativity that is demonstrably more effective than are solo strategies (Carmagnac *et al.* 2022).

Critics of multi-stakeholder partnerships refer to the traditional, imbalanced power dynamics among individual stakeholders, particularly citing multinational corporations. They contend that the discursive practices of global corporate actors have the potential to skew power relations to benefit their own interest. They also suggest that the drive for consensus among stakeholders can influence who is invited to be seated at the table (Carmagnac *et al.* 2022). Therefore, it is important that any roundtable created is cognisant of, and avoids, reinforcing the power and framing of issues from 'the usual suspects' of industry and science representatives (Reed *et al.* 2009; Knight and Knox-Hayes 2015; Colvin *et al.* 2016). Determining who may be seated at the table needs to be a transparent and open process that reinforces legitimacy and relevance.

An example of this is the integral leverage point in these systems, the region of NRM/extension/landholder engagement counterparts that have not previously had a 'seat at the table.' These bodies are integral, because of the relationship and trust that exists with the landholder (Dhanda and Murphy 2011; Reed *et al.* 2022). However, it has been noted that these roles are perhaps already overburdened and that this (ecosystem service markets) is not their area of expertise. From the participants, two potential options arose. The first was that there should be more capacity development and upskilling of these positions, to help with the inherent complexity. The second was the creation of a new role within these circles, for an expert or series of trained persons, with broad knowledge of these market areas. These regionally based positions would also have the insights of unique local challenges that are not being captured (current gap) and allowed for in the method and crediting of existing markets.

Traditional roundtables generally use conventional means (the processes of interaction, deliberation, decision-making and enforcement) to address issues, but which may not be optimal for confronting wicked problems. Complex systems and wicked problems are inherently non-linear; they entail many interactions and interdependencies, and are characterised by conflicting views amidst considerable knowledge uncertainty, all posing formidable organisational challenges (Dentoni *et al.* 2018).

Avoiding these pitfalls of 'traditional' roundtable approaches would be critical. The recommendations from this research are not intended to be prescriptive of how a multi-stakeholder partnership approach would be formed, or who would be involved. But we can highlight some attributes that would be addressed that have emerged from the study. For example, it is clear that such an approach would require national leadership and support, as well as encourage and support innovation. This is illustrated by the concept of 'sand-pitting' (testing out potential ideas) as advocated by some participants. Wicked problems require innovation and creativity (Dentoni *et al.* 2018; Owen *et al.* 2018; Zakari *et al.* 2023). Therefore, the inclusion of a vehicle within the roundtable to support innovative and creative 'sand-pitting' would be essential. The data also highlighted the debate around progressing these markets, and the urgency and time pressures to do so (urgency as a result of climatic events), and the arguments on whether any potential tool or solution must be 'perfect' prior to its application. A multi-stakeholder partnership could address this issue where the desire for perfection and absence of error is in direct opposition to the need for haste.

Among other issues that may be addressed with the use of a multi-stakeholder partnership or roundtable approach, and which were noted within the data, was leveraging private sector money to support these systems. How can we leverage industry finance to fill the funding gap (Kedward *et al.* 2023)? Is this listening to what the private sector is driving for? For example, there has been a divide in the way people perceive the 'right' way to deal with carbon credits being produced. The 'in-setting versus off-setting' debate was noted within the interviews. This divide exists in part as there are unclear signals from the market as to where the most value lies. Notably, private sector participants tended to prefer the in-setting approach.

A multi-stakeholder partnership or roundtable approach could help alleviate some of the symptoms of the wicked problem associated with ecosystem service markets that were highlighted in this study.

## Supplementary material

Supplementary material is available [online](#).

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**Data availability.** Ethics does not allow sharing of raw data, but the coding is available in detail in supplementary materials.

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