SA Pastoral Rangelands: Carbon Potential Report

January 2021

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Report prepared by

RegenCo
Natural Capital Specialists

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Table of contents

Executive summary

Natural capital can be defined as the world's stock of natural resources – including minerals, soil, air, and water, as well as all living organisms and ecosystems.

This capital provides a range of services to us – food we eat, air we breathe and some less visible, such as the climate regulation and natural flood defences provided by forests, the billions of tonnes of carbon stored in soils and native woodland, or the pollination of crops by insects.

The markets for non-renewable natural capital (e.g. mineral resources) are well understood and follow principles of supply and demand (e.g. iron ore or gold price). With the realisation of climate change and its impacts, there is increasing recognition and interest in markets for renewable natural capital assets (e.g. vegetation, soil, carbon storage and biodiversity) that has started to enable these assets to be more appropriately valued.

In Australia (and globally), the development of the carbon market has accelerated dramatically over the last nine years – particularly across the pastoral zone of Australia.

However, it is not without its challenges. Participation in the carbon market is not evenly distributed across states. There are currently only three Human Induced Regeneration (HIR) projects registered with the Emission Reduction Fund located in the South Australian Rangelands and none that have generated an Australian Carbon Credit Unit (see pages 14-15 for further explanation). Nationally, the largest number of projects occur in Western NSW, Southern rangelands of WA and South West Qld – amounting to just over 300 operating HIR projects.

This report was commissioned by the Outback Communities Authority to undertake an economic analysis and explore the benefits, barriers, and business implications of undertaking the HIR carbon abatement methodology on the South Australian pastoral zone.

The report provides a brief perspective on the global shift to reduce greenhouse gas emissions and how the finance sector, including banks, are responding to climate change by seeking to reduce their risk exposure. It also looks more closely at the carbon market as it operates in the Australian rangelands today and provides a detailed explanation of land systems and specific enterprise types in the SA rangelands that have opportunities in the carbon economy.

The analysis shows the exciting potential for HIR carbon farming projects to provide income diversification and increased revenue opportunities for pastoral businesses across the South Australian pastoral zone.

In addition to revenue, this market will also increase the value of rangeland businesses. As the condition of the natural capital base improves, this will enable improved gross margins across grazing enterprises. The analysis of the biophysical capacity of the entire pastoral zone to generate carbon abatement was based on 60 land systems of greater than 200,000 hectares that had "high" or "moderate" potential to achieve "forest cover" from a current condition of "non-forest". This analysis showed that potentially a total area of approximately 34 million hectares showed suitability.

If we assume that 10% of the assessed area was able and participated in HIR projects, the result would be around 35 million carbon credits created over a 25-year project lifetime. This gives an annual average of just over 1.4 million carbon credits created, valued at $28M (at average long run market price of $20/tCO2e) in SA rangelands per year from HIR projects alone.

If we assume that 20% of the assessed area was able and participated in HIR projects, the result would be around 69 million carbon credits created over a 25-year project lifetime. This gives an annual average of just over 2.8 million carbon credits created value of $56M (at $20/tCO2e) in SA rangelands per year from HIR projects alone.

If we assume that 30% of the assessed area was able and participated in HIR projects, the result would be around 104 million carbon credits created over a 25-year project lifetime. This gives an annual average of just over 4.2 million carbon credits created valued at $84M (at $20/tCO2e) in SA rangelands per year from HIR projects alone.

These are modelled results, and verification of these results and outcomes for individual pastoral businesses will always require localised evaluation at the scale of individual land systems or properties.

The biophysical analysis of the SA pastoral land systems was also used to develop three whole-of-business case studies of pastoral enterprises to examine the potential financial and economic impacts of HIR carbon projects. The three case studies were developed covering the main livestock enterprises in the pastoral area of South Australia, namely:

- Beef cattle
- Meat sheep
- Merino wool sheep.

Data used in the modelling is based on actual enterprise data from existing SA pastoral enterprises and the farming systems selected represent major land use and type in the state's rangelands.

These case studies, based on the predicted carbon yields of the land systems used and the current market price of carbon, show that HIR carbon projects could provide considerable financial benefit to landholders – in conjunction with pastoral businesses. In fact, for some pastoral enterprises and land systems, carbon farming projects have the potential to provide a higher income per hectare than livestock. However, there are also significant biophysical, legislative and socio-economic implications and risks that need to be considered (outlined in Section 4 and 5 of this report).

This report advocates for an approach that integrates carbon farming into existing pastoral enterprises, as one that will be central to minimising risk and fully realising the available benefits.

The development of carbon farming across Australia continues to gather momentum and will play a significant part in the agricultural landscape into the future. Climate change impacts and the forecast changes to rainfall frequency and more extreme weather events are already and will continue to exacerbate risks to sustainability and resilience in the pastoral industry[1].

The challenge is how the entire rangelands community will work together to find new approaches and markets that increase profitability and support keeping people on the land to drive the regeneration of our critical natural capital resources. New natural capital markets will be critical to support rangelands enterprises and livelihoods, so they can continue to provide the state (and world) with food and fibre, as well as provide payment for the value created for society in terms of carbon storage, biodiversity protection and soil conservation.

[1] Bureau of Meteorology, State of the Climate, http://www.bom.gov.au/state-of-the-climate/

Preface

This report was commissioned by Outback Communities Authority (OCA) to support pastoral businesses, relevant industry stakeholders and Government agencies to better understand the opportunity, benefits, and considerations of carbon farming to pastoralists and broadly to the state of South Australia.

The project was managed by the Department of Primary Industries and Regions (PIRSA), with funding provided by the Australian Government, under its Drought Communities Program.

Report author, RegenCo is a natural capital asset management firm providing innovative solutions and holistic support for landholders undertaking natural capital regeneration and land management. RegenCo seeks to accelerate the shift towards a regenerative approach to agriculture by bringing their wealth of experience in land and agriculture management to assist and partner with landholders and investors. RegenCo believe that regenerative agriculture can improve profitability of farming enterprises, increase the resilience of regional communities, and make a real impact on greenhouse gas emissions, while continuing to help feed and clothe our society. RegenCo is an active carbon project developer working with pastoral enterprises, government, and corporations. Further, RegenCo provides extensive policy and program advice and support to Australian state governments, leveraging their experience and knowledge of engaging within carbon markets, both locally and globally.

The aim of this report is to provide information that is needed by both landholders and policymakers to assess the economic opportunities, barriers and risks associated with emerging natural capital markets[2] - particularly carbon farming.

This report seeks to support landholders and government to:

- understand the required steps to maximise the identified market opportunities
- undertake a considered approach to natural capital market development to help maximise the impact of projects that deliver economic, social, and environmental good
- make decisions with high quality and transparently derived information from trusted sources
- make decisions based on clearly identified and understood risks and opportunities, and to understand how these decisions impact their existing enterprises in the long-term, and
- be alert to opportunities future developments that may be of economic importance if the current opportunities do not suit their interests or risk appetite.

Specifically, this report focuses on the benefits and implications of undertaking the Human Induced Regeneration methodology on the South Australian Rangelands (which is discussed in detail later in the report). This report seeks to articulate how an integrated approach to incorporating carbon farming alongside pastoral enterprises can lead to positive impacts including:

- Growth in the agricultural sector in line with national and state growth targets
- Increasing job opportunities in the recovery from the COVID 19 pandemic
- Longer term economic resilience for the industry
- Improved condition and extent of native species populations of plants and animals of the South Australian rangelands

[2] Natural capital comprises stocks of natural resources—including minerals, soil, air, water, as well as all living organisms and ecosystems—which produce flows of ecosystem services- or what nature provides to us for free. The markets for non-renewable natural capital (e.g. mineral resources) are well understood and follow principles of supply and demand (e.g. iron ore or gold price). We often lack markets for the renewable natural capital e.g. biodiversity of rangelands, or soil and groundwater health that would allow those assets to be more appropriately valued.

- The carbon economy environment including the national legislative and policy framework, and the commercial landscape
- The potential of carbon farming across the South Australian pastoral zone.
- What pastoralists should consider when assessing whether they would benefit from incorporating carbon farming as part of an integrated approach to land use and farm management (eligibility requirements, risks, costs, and obligations)
- How pastoralists can commence carbon farming and generate credits to supplement the financial returns from their enterprise.

About the authors

Dr. Tim Moore

Tim has almost 20 years of experience across natural resource management, conservation land management, carbon markers (buy and supply side) and agribusiness innovation.

He has worked extensively to develop both voluntary standard and compliance market carbon credit generating projects including development of biodiverse carbon, savanna burning and human induced regeneration on both public and private lands.

Tim's expertise and knowledge in the science and methods of land management, and practice in utilising the Carbon Farming Initiative and relevant policies, include the provision of extensive advisory services to WA, SA, and NT governments.

Tim, alongside John Gavin, is the primary author of this report, bringing together his knowledge and experience with the carbon market and its applicability within the South Australia rangelands.

John Gavin

John has over 23 years of experience in natural resource management, currently operating his own business specialising in natural resource management (NRM) and is also the Chief Executive Officer of Cape York NRM. John has operated Remarkable NRM, since 2011, specialising in NRM services and solutions for Regional NRM organisations across Australia. He has extensive experience with supporting land managers, state agencies and natural resource management organisations, to understand the opportunities and risks associated with Carbon Farming, particularly across the rangelands of Australia. He has authored numerous reports on the opportunities and impacts of the carbon economy as it relates to natural resource management and currently co-chairs the Carbon Working Group for NRM Regions Australia

Prior to this John was the General Manager for the South Australian Arid Lands Natural Resources Management Board. As General Manager he was accountable to the SA Arid Lands Natural Resources Management Board for the strategic management, leadership and effective performance of the board in both its strategic objectives and management of resources. John was the General Manager from the board's inception in 2004 during which time the size and scope of the Board increased substantially. John came to this position after a broad and practical work history with community based natural resource management through several positions across Australia. He has extensive expertise in this field and demonstrated experience within the Australian Rangeland's community.

John has an in-depth knowledge of the SA Arid lands and has served as a board member for the Regional Development Authority for the Far North of SA and has previously delivered workshops and provided policy and strategic planning support for the SA Arid Lands region in regards to the Carbon economy and NRM. He has also provided advice to land managers across the SA Arid Lands in regards to participation in the carbon economy and the implications or their enterprise.

Rosemary Bartle

Rosemary has spent 35 years working with land managers, across the length and breadth of the Australian rangelands, to build resilient families, businesses, land, livestock, and communities. Her work has included working with pastoralists in assessing the feasibility of carbon opportunities in SA, which were an input into the case studies for the Climate Change and Carbon Economy Extension in SA Arid Lands.

Assessing the economic, environmental and social feasibility of opportunities has been central to this work; from unearthing development opportunities, diversification and management interventions at the individual property level, to assessing the feasibility of community-scale green-field developments.

Rosemary has developed numerous decision support tools which take into account the whole business, enabling land managers to assess the full financial impact of regenerative agriculture and development opportunities.

These tried and tested tools, built through years of experience, underpin RegenCo's modelling of feasibility assessment and forms the basis of the case studies are found within this report.

Dr. Steven Petty

Dr. Petty has over 35 years of experience managing and developing the economic sustainability of farming businesses in Australia. He is currently the Managing Director and Marketing Manager of a 60,000 herd cattle and farming business in North Australia.

Steven is an expert advisor in managing and balancing the relationships between cattle business management, emission intensity, carbon sequestration and land condition, supporting a range of pastoral and indigenous cattle businesses across Australia.

Steven is also an Associate Professor at the University of Queensland and works closely with the NT and WA governments as a specialist advisor in rangelands systems.

Steven's carbon potential analysis, working alongside Matt, forms a significant component of the inputs into this report.

Dr. Matthew Bolam

Matt has over 30 years of experience providing a range of advice to farmers and graziers in Natural Resource Management and cattle production across Northern Australia.

His focus is on supporting farmers and landholders who are open to integrating Natural Resource Management concepts and principles within cattle production enterprises, which not only looks after the land, but also strengthens the resilience of the enterprises themselves.

Throughout Matt's career, he has worked with the Australian, NT and WA governments, local government, indigenous organisations, land holders, land valuers and others to help shape a sustainable future for the rangelands.

Matt's desktop mapping and carbon potential analysis formed a significant component of the inputs into this report.

Hubert Lau

Hubert has been a career strategy and operations management consultant with experience working across a range of industries and organisations, with an interest in helping meaningful organisations deliver a greater future for society. He is supporting the strategic development and the operational management of RegenCo. Hubert holds an MBA from the Saïd Business School at the University of Oxford.

Introduction

Australia has made commitments to progressively reduce Greenhouse Gas (GHG) emissions, most notably under the Kyoto Protocol and the Paris Agreement[3]. The need to reduce emissions led to the creation of the Carbon Farming Initiative (CFI), which enabled farmers and land managers to generate Australian Carbon Credit Units (ACCUs) for sale into the carbon market. More recently, under the Emissions Reduction Fund (ERF), the ability to generate ACCUs has been expanded to cover all sectors of the economy, providing much greater competition for land managers looking to benefit through participation in carbon markets. The commitments, legislation and regulation of the generation and sale of carbon credits collectively establish the carbon market.

To ensure market validity, a land manager must follow an approved 'method' to generate an ACCU. A method is the rules that apply to each particular type of project and these outlines what activities can be delivered, where they may be undertaken, how they are monitored and how the number of ACCUs generated is determined.

The system was designed so that land managers could participate as individuals or collectively without the need for further support. However, due to the complexity of the methods and the upfront costs involved in participation, the majority of land managers that have participated to date have signed agreements with third-party project developers. A number of financial models are in use, including a straight fee for service model, a payment based on the number of credits generated or a percentage payment based on project financial return.

Development of the carbon economy across the pastoral zone of Australia has accelerated dramatically over the last nine years. Today, over 82% of all contracted abatement under the ERF is contracted to land sector projects with the Human Induced Regeneration (HIR) method providing 23% of all ACCUs issued and the Avoided Deforestation method providing 24%, almost entirely based in the rangelands of Australia.

Participation in the carbon economy is not evenly distributed, with the largest number of projects occurring in Western NSW, Southern rangelands of WA and South West Qld. This reflects the dominance of vegetation sequestration opportunities and jurisdictional policy settings that enabled early participation. NSW, Qld and more recently WA, are jurisdictions that have confirmed that pastoral leaseholders can generate and trade ACCUs from sequestration activities, and both NSW and Qld had policy settings that enabled the early uptake of vegetation sequestration methods for the avoided clearance of a native forest or the human induced regeneration of a native forest. Additionally, the Qld government has developed a specific method to enable the generation of ACCUs from the cessation of the clearance of woody regrowth on country that had been cleared previously.

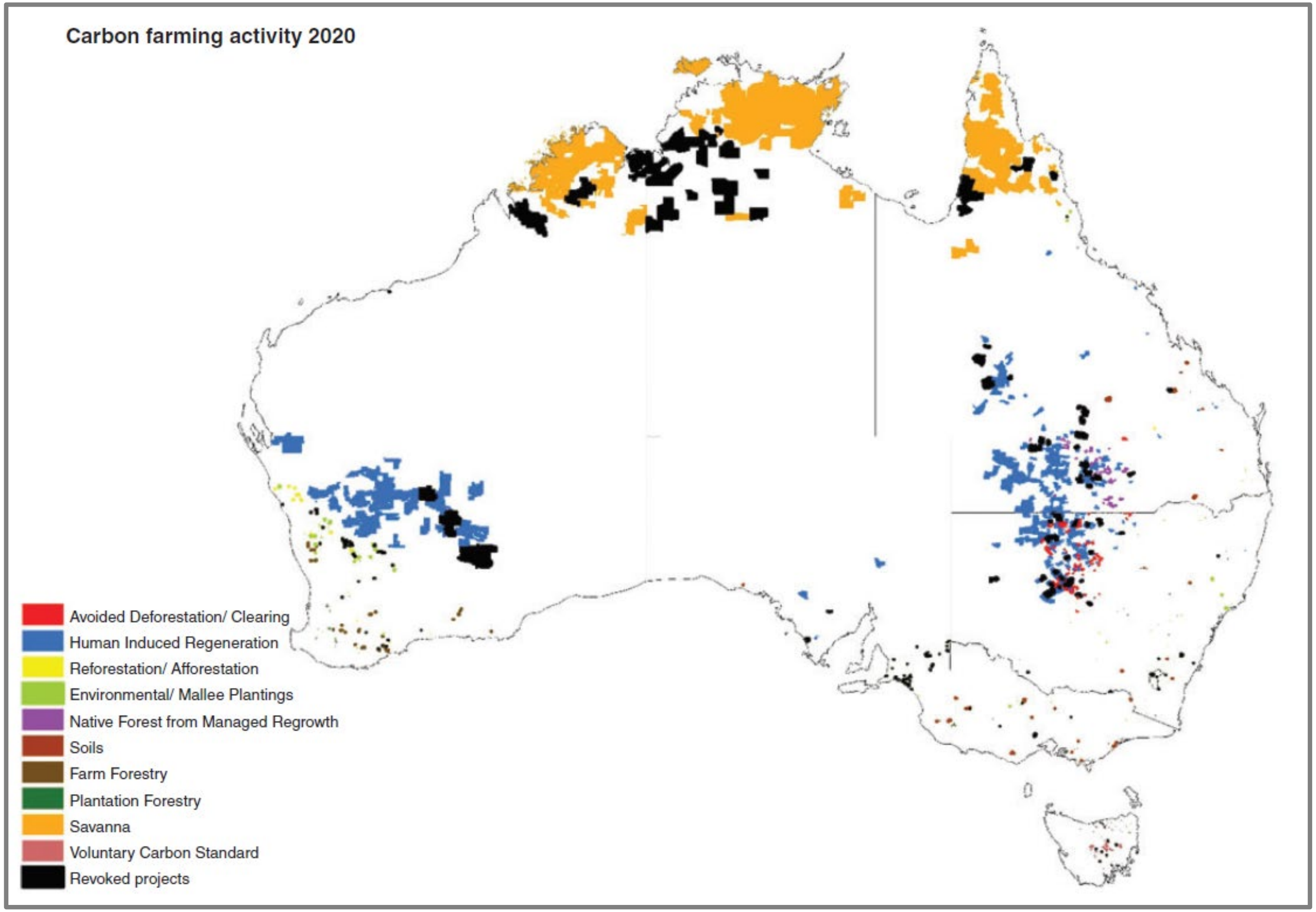
This is in stark contrast to the three projects registered in the South Australian Rangelands, only one of which is contracted under the ERF and the other two have not generated an Australian Carbon Credit Unit. However, industry advice suggests there are a number of pastoral enterprises who have entered, are currently negotiating or investigating potential contracts with carbon service providers.

Estimates of the full value of vegetation-based rangelands located ACCUs that have been sold or are contracted for sale over the next 7–10 years (based on the published average price of the first 11 ERF auctions) indicate a value of approximately $1.7 billion nationally. In a relatively short period of time, this new market has become a significant income source across the Australian rangelands (though largely not yet realised in South Australia).

The emergence of the carbon economy in Qld and NSW, and now WA, has provided a once in a generation opportunity for landholders. The alternative income has been used to develop infrastructure and improve land management in a pastoral economy dealing with increasing challenges to profitability. Diversification has provided much needed cash flow during drought periods and enabled proactive enterprise succession planning.

[3] Additional detail on the Kyoto Protocol and Paris Agreement are provided in Appendix 1.

Figure 1: *Current distribution of different carbon farming projects in Australia showing the development of projects in the NSW, Qld and WA pastoral zone and the corresponding lack of projects in SA4*



[4] Carbon farming for resilient rangelands: people, paddocks and policy. Alex Baumber et al. 2020. The Rangeland Journal - https://doi.org/10.1071/RJ20034

Section 1: Carbon Farming in Australia

What is "carbon farming"?

Carbon farming is any change to agricultural or land management practices that can reduce GHG emissions (such as nitrous oxide and methane) or store additional carbon in vegetation and soils. Primary production, including pastoral land use, plays an important role in reducing emissions and storing carbon.

These changes in practices can provide a range of accepted benefits to landholders such as increased profitability, production and biodiversity, as well as, improvements to their natural capital – and the earning of Australian Carbon Credit Units (ACCUs), which can be sold and provide an additional income stream to landholders.

There are two ways to "farm" carbon and earn saleable credits:

- by avoiding (that is, eliminating or reducing) agricultural emissions that would otherwise have occurred by changing, or introducing, specific on-farm practices designed to reduce GHG emissions. For example: reduced methane emissions from livestock, reduced fertiliser emissions, manure management, savanna fire management or,
- by sequestering CO_2. Sequestration is the general term used to describe the natural processes that remove CO_2 from the atmosphere and store it in vegetation or soil. This includes human induced regeneration, carbon forestry, avoided deforestation and soil carbon (reducing carbon loss or increasing sequestration).

Land use, land use change and the forestry sector, including agricultural land use, play an important role in storing carbon and sequestering carbon in vegetation through land management changes. In South Australia, the land use sector acts as a 'carbon sink', meaning that activity in the sector actually removes more carbon from the atmosphere than it releases. Reducing the amount of land-clearing in Australia is one step in reducing our overall carbon emissions. However, this is only part of the equation, encouraging regrowth and afforestation is equally important. Reducing emissions through more efficient production of beef cattle is a current opportunity that is also gaining increasing attention.

Benefits and risks of carbon farming associated with agriculture

Carbon farming (increasing carbon sequestration or reducing emissions) can be a key aspect of an integrated regenerative approach to agriculture and land management. Incorporating carbon farming with an agricultural enterprise supports the regeneration of the land, providing several direct benefits and ultimately strengthening the resilience of the enterprise.

The land regeneration required increases the underlying health of the soil, which provides a stronger foundation for permanent groundcover development for pastoral grazing, and to weather the variability of Australia's potential dry seasons. On top of that, through participation in a carbon credit generating scheme, carbon farming could provide ACCUs, which when sold, provide a supplementary income source for the enterprise. Income which can be used to fund reinvestment into the enterprise infrastructure, or to financially 'drought proof' the enterprise during periods of low productivity and/or extended dry times.

The result of an integrated regeneration approach is that livestock are more productive, agricultural enterprises are more profitable and surrounding communities are more vibrant.

Some current carbon farming projects are focussed on maximising the production of ACCUs, and in some situations, at the expense of other enterprise activities. Undertaking carbon farming by itself tends to ignore the complementary impacts of carbon farming alongside or within an agricultural enterprise. By just focusing on sequestering carbon and/or reducing carbon emissions, the overall environmental and social benefits of well-managed livestock grazing the rangelands are then lost. The danger of concentrating our effort on maximising carbon sequestration alone is that livestock and economic activity may be removed from vast areas of the rangelands for extended periods which, over time, causes an overall decline in local and regional productivity. This may lead to an increase in weeds and/or feral animals and declining land condition, as "carbon only" projects see reductions in land management on pastoral leases. This would be accompanied by a loss of jobs from the regions and less vibrant communities.

Despite the safeguards built into the Carbon Credits (Carbon Farming Initiative) Act 2011 and the project methods, several projects being undertaken across pastoral zones in other states can be considered as having negative land management outcomes. The definition of a forest (an area of land greater than 0.2Ha with a canopy cover of greater than 20% and taller than 2 metres) has meant that large areas that used to be considered invasive native scrub is now valuable native forest. Additionally, the HIR method encourages the increase of native woody species that may have previously been considered to negatively impact on natural resources through reduced ground cover and carrying capacity.

Fully integrating the delivery of carbon farming projects within existing enterprises, while maintaining the viability and diversity in existing income generation and land use, is key to ensuring ongoing sustainability of food and fibre production systems. This report advocates for this fully integrated approach to limit the risks outlined above and maximise the opportunities to landholders, regional communities and the broader economy.

Section 2: The national legislative, policy and commercial environment

The opportunity for land managers in the South Australian pastoral zone to participate in the carbon market revolves around the Carbon Farming Initiative (CFI). The CFI was established in 2011 and is defined in the *Carbon Credits (Carbon Farming Initiative) Act 2011*.

The original intent of the CFI, which continues to have bipartisan government support, was to provide a mechanism whereby those sectors not included in an Emissions Trading Scheme could generate carbon credits by implementing projects that reduced carbon emissions or resulted in sequestration of carbon in soils or biomass. As the name suggests, the CFI was primarily targeted at the agricultural and forestry sectors but also included some aspects of waste management.

Under the CFI farmers generate carbon credits through reduction in emissions or long-term storage of carbon in biomass or soil, by implementing projects in accordance with defined methodologies. CFI Methodologies define:

- who can undertake projects – basically what types of land and existing land management practices can be included;
- what activities have to be undertaken to comply with the methodology and;
- the measurement, monitoring and reporting requirements.

Any credits generated by projects are registered in a registry as Australian Carbon Credit Units (ACCUs) and can be traded either through the ERF or direct to other purchasing entities.

Australian Carbon Credit Units (ACCUs) and agriculture

Any income from the sale of ACCUs, along with the co-benefits from carbon farming, will have costs attached to it. Setting up and maintaining a carbon farming project involves costs and risks. There is the cost of undertaking the actual activity or implementing the management change and then there is the separate cost of generating the carbon credit - the extra business administrative and accounting costs.

Subject to satisfying the monitoring, auditing, reporting and other requirements under the ERF, an eligible ERF project can apply for ACCUs. Each ACCU represents one tonne of carbon dioxide equivalent (CO_2e) net abatement (through either emissions reduction or carbon sequestration) achieved by eligible activities – in accordance with an approved Methodology.

An ACCU is a ‘financial product’ under the *Corporations Act 2001* and the Australian Securities and Investments Commission Act 2001. Also, of note, income from ACCUs is dealt with in a different manner to Primary Production income by the Australian Taxation Office. [5]

The Emissions Reduction Fund - The Australian Government program for carbon farming

The Australian Government established the Emissions Reduction Fund (ERF)[6] in 2014 as a means to achieve Australia’s 2020 emission reduction target. The ERF sets out ways that industry can be a part of reducing GHG. The ERF is voluntary and includes all sectors of the economy and aims to seek the lowest cost abatement. Carbon farming remains the primary means for the agricultural sector to participate in the ERF. The ERF was established initially with $2.5 billion to purchase ACCUs from producers and this has since been increased by a further $2 billion committed in 2019 as part of the ‘Carbon Solutions Fund’.

[5] The tax treatment of the sale of ACCUs is assessable under Division 420 of the Income Tax Assessment Act 1997.
[6] More information on the ERF can be found at http://www.environment.gov.au/climate-change/emissions-reduction-fund

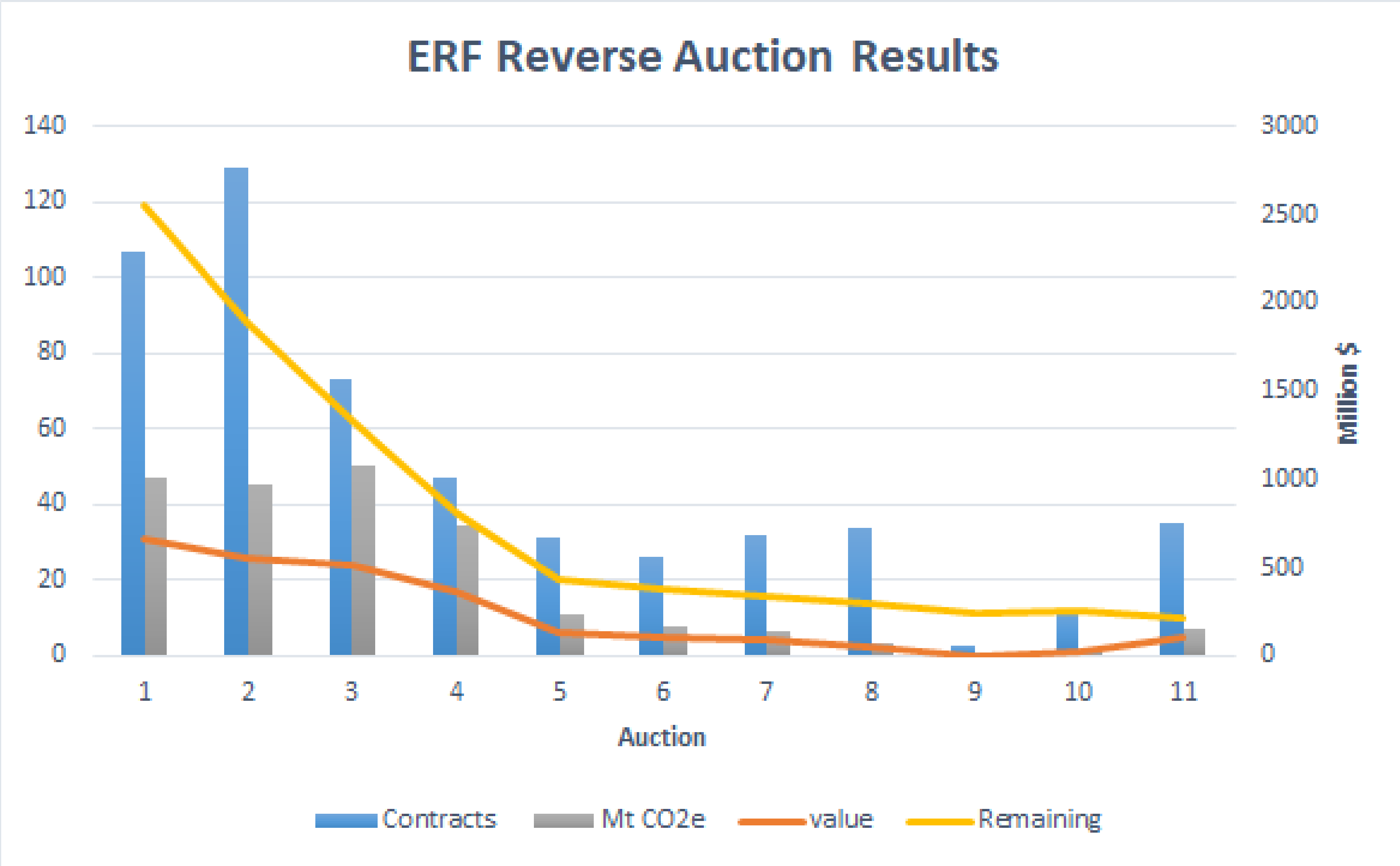
The ERF has three parts:

- **Contracting:** the Australian Government contracts for the supply of ACCUs[7] via a voluntary reverse auction process that seeks to purchase lowest cost abatement in the form of ACCUs from land managers, carbon service providers, and industrial efficiency activities. The Australian Government has committed approximately $2.4 billion to date.
- **Crediting:** The Clean Energy Regulator is responsible for crediting and verifying ACCUs generated through registered projects. These projects may have a contract with the Australian Government or be generating ACCUs for the supply to voluntary or other secondary markets such as under the Safeguard Mechanism. *The Carbon Credits (Carbon Farming Initiative) Act 2011* is the key legislation that enables the creation of ACCUs and was developed with bipartisan support.
- **Safeguarding:** The Safeguard Mechanism seeks to ensure that the savings secured through the contracting process are not overtaken by carbon pollution from high emitting industrial sources. This has the potential to be a major source of new demand for ACCUs if Australian Government adjusts the targets for entities under the Safeguard Mechanism.

The performance of the ERF has varied over time. Early auctions provided significant contracted abatement but in later auctions, the level of contracted abatement barely maintained pace with previously contracted projects that were withdrawn. The reduced volumes of ACCUs being contracted is due to the continued low prices being offered, the reduction in new vegetation projects across the rangelands, and an ongoing lack of supply. In the most recent auction, a change in contract terms has resulted in a slight increase in activity and the market is watching the regulator for signs of further changes that will reduce project risk and increase returns.

[7] More information on ACCUs can be found at http://www.cleanenergyregulator.gov.au/OSR/ANREU/types-of-emissions-units/australian-carbon-credit-units

Figure 2: *ERF auction results showing the value of contacts entered, the quantum of contracted abatement, contract value and remaining ERF funds.*[8]



[8] Compiled based on ERF Auction Results. Individual auction results can be found at http://www.cleanenergyregulator.gov.au/ERF/Auction-results

Other policy drivers to reduce emissions or create credits

The regulated financial sector of Australia is built on three key institutions: The Reserve Bank of Australia (RBA), the Australian Prudential Regulatory Authority (APRA), and Australian Securities and Investment Commission (ASIC).

Financial and Company Duties

The RBA is responsible for conducting monetary policy, maintaining stability in the financial system and promoting efficiency and competition in the payments system. The RBA also issues Australia's banknotes and provides banking services to the Australian Government.

The RBA has stated[9] that climate change poses some material risks to Australian financial institutions. It has identified examples of these risks include changing rainfall patterns that result in lower or less predictable income from agriculture, more frequent storms disrupting supply chains and therefore sales, and damage to natural assets. As a result of this, banks will be exposed to risks because of potential impacts suffered by debt holders not being able to service their debt or impacts to the value of the collateral (such as property values) they are lending against.

APRA is the second pillar of the Australian finance and regulatory system. APRA is responsible for promoting the prudent management of regulated institutions so that they can meet their financial obligations under all reasonable circumstances. APRA supervises banks, credit unions, building societies, general insurance and reinsurance companies, life insurance, private health insurance, friendly societies, and most of the superannuation industry.

In February 2020, APRA released a letter[10] to all APRA-regulated entities entitled "*Understanding and managing the financial risks of climate change*". This notified regulated entities that at a minimum they need to understand the financial and physical exposures of their businesses to climate risk, as previously identified by the RBA.

The third pillar of the finance and regulatory system is ASIC, which works closely with APRA to ensure continuity and consistency of approach. ASIC has the legal role of, amongst other things, to maintain, facilitate and improve the performance of the financial system and entities in it, promote confident and informed participation by investors and consumers in the financial system, and administer the law effectively and with minimal procedural requirements. Recently, ASIC issued the following information in an update notice[11]:

> *"While disclosure is critical, it is but one aspect of prudent corporate governance practices in connection with the mitigation of legal risks. Directors should be able to demonstrate that they have met their legal obligations in considering, managing and disclosing all material risks that may affect their companies. This includes any risks arising from climate change, be they physical or transitional risks."*

In short, the RBA, APRA and ASIC have all identified that climate change poses physical, business and transition risks to the Australian economy and some sectors such as agriculture are particularly exposed. They have also recognised all entities should recognise how those risks may manifest for them, what the emissions profile is of their business, or the emissions profile of businesses they invest in. These considerations will flow into the agriculture sector by financiers taking an increased interest in the emissions from an enterprise, and what the business is doing to prepare for possible risks and opportunities that may be emerging.

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[9] https://www.rba.gov.au/publications/fsr/2019/oct/box-c-financial-stability-risks-from-climate-change.html

[10] https://www.apra.gov.au/understanding-and-managing-financial-risks-of-climate-change

[11] https://asic.gov.au/about-asic/news-centre/find-a-media-release/2019-releases/19-208mr-asic-updates-guidance-on-climate-change-related-disclosure/.

Net Zero Emissions by 2050: the goals of the Paris Agreement

While the policy recommendations by the Australian Government financial regulators have not been explicit, they tend to reference the goals of the Paris Agreement, with a target of net zero emissions by 2050. Countries around the world that have publicly committed to Net Zero Emissions (NZE) by 2050 include[12]:

- South Korea
- Japan
- China[13]
- United Kingdom
- The European Union

It is important to note that China, South Korea and Japan are amongst Australia's largest trade partners, and the EU and the UK also remains a key destination for Australian produce and resources. A key risk Australia faces is that key export markets may implement a "Carbon Border Adjustment Mechanism" (CBAM). Basically, this would occur if produce and resources coming into the EU were coming from places that did not have comparable emission reductions being achieved as were occurring in the EU. For Australia, this may mean, for example, Australian beef, wool and lamb/mutton may face border tariffs that make them more expensive to buy in Europe, to favour produce from producers or countries that demonstrate lower emissions.

There are 187 countries that have committed to achieving the net zero emissions position by 2050 as a signatory to the Paris Agreement. Australia, while a signatory to the Paris Agreement, has not committed to an NZE position. Diplomatic pressure to commit to this target is growing and is expected to continue in the lead up to the UK hosting the 26th UN Climate Change Conference of the Parties (COP26) in Glasgow on 1 – 12 November 2021. The COP26 summit will bring parties together to accelerate action towards the goals of the Paris Agreement and the UN Framework Convention on Climate Change. It is the role of the host party to encourage all attending parties to develop in advance and present at the Conference their best endeavours to play a meaningful role in meeting the Paris Agreement. The recent win in the US elections by the Democrat candidate, President Elect Joe Biden, is expected to add further political pressure to Australia to move towards a NZE 2050 position, as committed by Biden in the run up to the election.

The recommendation from the Australian financial regulators, consistent with the goals of the Paris Agreement, are being taken seriously by large investors in Australia:

- At least 20% of the Superannuation market in Australia has already identified a net zero by 2050 position for their investment portfolio[14], which will flow through all their investments including banks and publicly traded agricultural businesses.
- Banks like Rabobank[15] and ANZ[16] have identified the need to quantify an emission profile of their client base, and to see those emission profiles trending downwards. Continuing to hold or acquiring new debt may require mortgagees to show an understanding of their emission profile, and having in place a credible emission reduction plan.

[12]https://news.un.org/en/story/2020/10/1076132.
[13] The Chinese target is for Net Zero emissions by 2060
[14] https://www.climateworksaustralia.org/resource/net-zero-momentum-tracker-superannuation-sector/
[15] https://www.rabobank.com.au/media-releases/2020/201019-a-green-future-for-red-meat-supply-chains/
[16] https://www.beefcentral.com/news/anz-moves-to-clarify-climate-lending-policy-industry-backlash/

Increasing demand for carbon credits

In 2017, World Bank issued an economic assessment of the price carbon would need to be globally to see Paris Agreement targets achieved. The report[17] concluded that the explicit carbon-price level consistent with achieving the Paris temperature target is at least US$40–80/t$CO_2$ by 2020 and US$50–100/t$CO_2$ by 2030, provided a supportive policy environment is in place.

The global drive to reach NZE by 2050 has increased the awareness and interest in carbon credits. As the Paris agreement and targets loom closer, demand for carbon credits is anticipated to rise and thus market analysts anticipate rises in the price of ACCUs in the coming decade. Highly regarded analysts, Market Advisory Group forecast carbon price based on expected emission reduction targets and corporate emission profiles in Australia to the end of 2030 is presented overleaf in Figure 3.

A number of trends are contributing factors to the continued rise in demand for ACCUs in Australia:

- Obligations to offset emissions under the National Greenhouse and Energy Reporting (NGER) scheme's safeguard mechanism
- Large emitters engaging "early" in the market to ensure they will be able to access the volumes of credits they think might be required for their operations later in the decade
- Industries voluntarily striving for emissions reductions or net zero
- Greater consumer interest and demand for zero or low emissions products or services
- Speculative buying and investment on the possibility of global carbon market development and linkages where it may be possible to secure carbon credits from other schemes (e.g. European Union Emission Trading Scheme EU ETS; New Zealand Emission Trading Scheme NZ ETS) to meet local demand

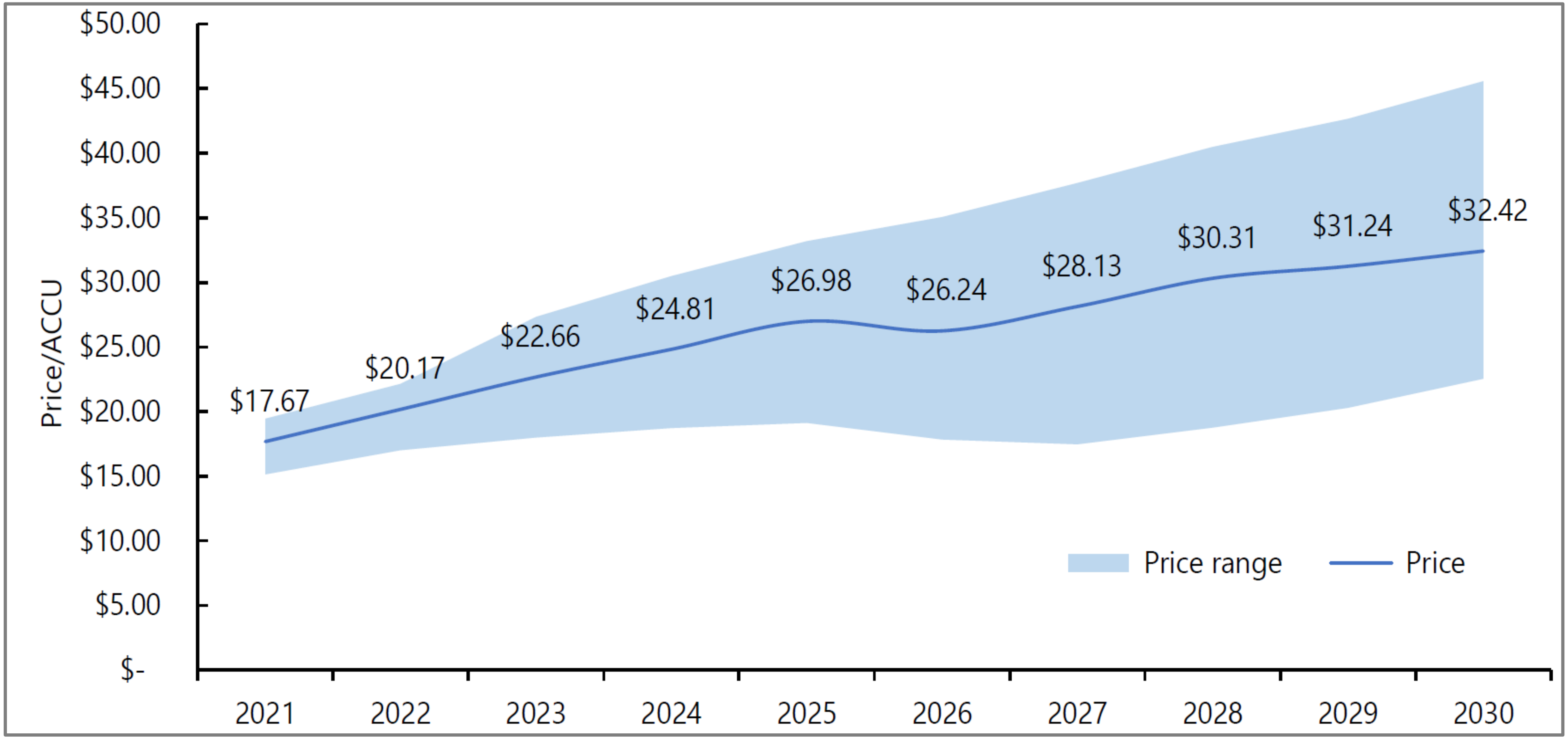
National Greenhouse and Energy Reporting- Safeguard Mechanism

The safeguard mechanism is established as part of the Emissions reduction Fund (ERF) and sends a signal to businesses to avoid increased emissions, by placing a legislated obligation on Australia's largest greenhouse emitters to keep net emissions below their emissions limit or baseline. The safeguard mechanism applies to businesses across a broad range of industry sectors including electricity generation, mining, oil and gas, manufacturing, transport, construction, and waste.

While businesses can and do seek opportunities to reduce their operational emissions, another option is to generate or purchase ACCUs and then surrender them to offset emissions over the baseline. This obligation has led, and is continuing to drive, a small portion of demand for ACCUs within Australian borders. Many large emitters are seeking to expand operations and undertake more activity, especially within the Liquified Natural Gas (LNG) and oil sectors that are bringing online massive infrastructure projects that will have multi-decade lifespans. The owners and operators of these production facilities will face possible obligations under the Safeguard Mechanism if the Australian Government aligns safeguard baselines with the aims of achieving the Paris Agreement and push towards harder emission reduction targets over time.

[17] https://www.carbonpricingleadership.org/report-of-the-highlevel-commission-on-carbon-prices

***Figure 3**: Projection of ACCU prices from 2020 to 2030 by Market Advisory Group October 2020 update*[18]



[18] Market Advisory Group are independent expert advisors in Australia's emerging carbon market and the renewable energy sector. With their decades of experience, they support organisations to develop carbon market strategies, analyse their carbon market risk, and provide government policy advice. This graph is reproduced within this report with MAG's consent. For more information or MAG's updated projections, please visit their website at marketadvisory.com.au

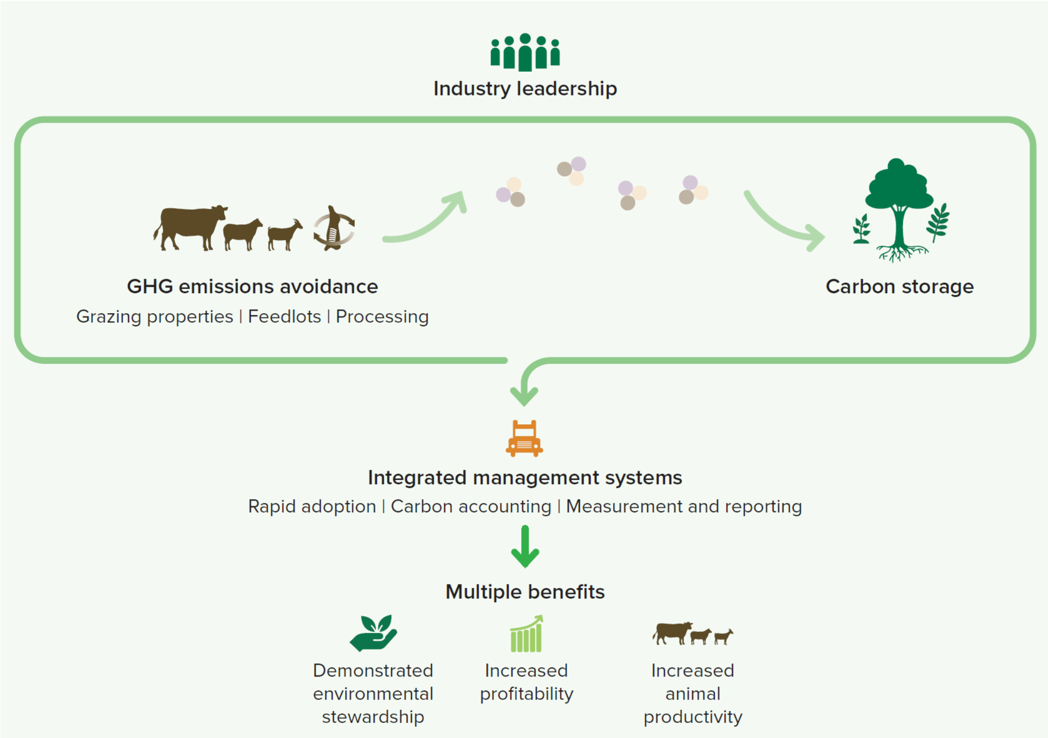
Voluntary action towards emissions reductions or net zero

Individual authorities, governments and peak bodies are individually taking the lead and setting their own targets to provide their stakeholders with goals to strive for.

Every Australian state and territory have independently committed to the target of net zero emissions by 2050. In February 2020, the SA Government set an interim target of reducing emissions by at least 50 per cent (from 2005 levels) by 2030, as part of its commitment to guide an orderly transition to net zero emissions in 2050.

Industry peak bodies also have committed to being carbon neutral by 2030. Importantly Meat and Livestock Australia (MLA), which regulates standards for meat and livestock management in Australian and international markets, has committed to being carbon neutral by 2030 as a means to increase profitability and maintain market access.

Figure 4. *The Australian Red Meat Industry's Carbon Neutral by 2030 Roadmap. Adapted from MLA report 2020*



Whilst reducing carbon emissions will form a big component of bringing these states and industries to carbon neutrality, it is anticipated that some emissions will ultimately persist, and these will require offsets. Agriculture as a sector, and in particular rangelands enterprises with their large land mass, represents a significant potential opportunity for the creation of carbon offsets to reduce the sector's emissions.

The National Farmers' Federation (NFF) has developed a growth strategy for the sector and have targeted $100Bn annual average revenue for the sector by 2030[19]. Of this total, the NFF expects to see at least 5% of this revenue target to be made up in payments to farmers for improvements in natural capital[20] condition on farms. The Australian Government have supported the NFF to develop natural capital opportunities for the agriculture sector, with new announcements expected in 2021[21]. That is an expectation of at least $50M of additional revenue annually flowing to farmers per year who are participating in regenerative agriculture projects by 2030.

[19] https://nff.org.au/media-release/nff-releases-2030-roadmap-to-guide-industry-growth/
[20] https://nff.org.au/key-issue/natural-capital/
[21] https://nff.org.au/programs/australian-farm-biodiversity-certification-scheme-trial/

Consumer interest and marketing appeal of zero or low emissions products or services

Organisations are increasingly monetising the low emissions status of their products or services, whether through establishing differentiation with competitors or encouraging consumers to pay a premium to offset their emissions and reduce their personal carbon footprint.

There are already brands, some Australian, using carbon neutral certification as a means of differentiating themselves from their competition including clothing lines, courier companies, coffee, and energy retailers. Major brands have pledged to be carbon neutral (Amazon by 2040, Microsoft by 2030, Starbucks before 2030) as part of establishing their business as sustainable and responsible to the environment. Importantly for the red meat sector, we see indications that major purchasers (including McDonalds) are looking to secure product in the supply chain with lower carbon footprint[22].

Another key driver for future markets reflecting an interest by consumers is the option to pay a small premium to offset emissions and personally be carbon neutral. Qantas and Jetstar have been offering their voluntary carbon offset program since 2009, where passengers can opt in and pay slightly more for their price to offset the emissions from their travel. Energy retailers have been offering their consumers various green options, whereby consumers pay a bit more above the product or service price to assure them that their energy is carbon neutral, or their carbon emission profile is offset. Meeting consumer expectations for carbon offsetting is achieved through the purchase of ACCUs, which in some cases is occurring through direct relationships with producers.

As the consumer market increasingly votes for options that are sustainable and carbon neutrality becomes a standard, demand for offset credits will grow.

Global markets allowing companies to secure carbon credits from overseas to meet local demand

Major global markets, such as the European Union, Japan, NZ, China, South Korea, and parts of the United States, have started to allow their corporations to source overseas carbon credits to meet local demand. This is due to the large demand, which outstrips their local supply, required to reach their emission reduction targets set by their respective jurisdictions as they strive towards their Paris Agreement obligations by 2050.

As more international trading takes place, demand for Australian carbon credits will increase and help bring global prices to a new equilibrium.

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[22] https://mcdonalds.com.au/sites/mcdonalds.com.au/files/Global_McDonalds_Scale_For_Good-Climate_Change_March_2018.pdf

Section 3: How could carbon credits be created in the SA pastoral rangelands?

Under the Carbon Farming Initiative, a project can only generate an ACCU if it is carried out in line with an approved method and the correct approvals are in place. A project can only be registered with the approval of all eligible interest holders on the land where the project will occur. Most of the SA pastoral zone is crown land leases and therefore the Crown (through the relevant Minister) must approve a sequestration project before it can be fully registered. There is also additional regulatory approval required under SA legislation, namely the *Pastoral Land Management and Conservation Act 1989.*

There is a wide variety of methods that are suitable for agriculture, however, only a few are currently applicable to the SA pastoral zone and even less are economically viable or practically feasible. These methods can be split between those that increase sequestration of carbon (sequestration is the general term used to describe the natural processes that remove CO_2 from the atmosphere and store it in vegetation or soil) or avoid emissions being produced. Critically, all methods require a land manager to undertake 'new' activity. This may be a change in land management or herd management practice, including possibly ceasing an existing practice.

To earn carbon credits, a project must be registered with the Emissions Reduction Fund, and follow the approved methodology to ensure ACCUs will be credited through the lifecycle of the project. This includes gaining consent from all parties with an interest in the land including the SA government, establishing a carbon baseline at project start, undertaking land management activities that are undertaken to increase carbon sequestration, monitoring of the changes according to the method, developing a report to report on project activity and performance, and being audited prior to submission to the ERF.

Sequestration methods

Sequestration in vegetation occurs via the process of photosynthesis—as plants use the energy of sunlight to convert CO_2 to carbohydrates for their growth and maintenance. The plant's growth reflects the amount of CO_2 it has taken from the atmosphere. The plant is generally capturing more CO_2 in the initial years of growth, slowing over time as plants grow to their full capacity as a carbon store. The amount of carbon that can be sequestered in vegetation varies with species, soil quality, climatic conditions, and land management practices.

Vegetation assists the retention of soil carbon. Appropriate management of agricultural soils by landholders can reduce the amount of organic carbon loss. Carbon accumulates in soil as vegetation dies. Some is incorporated into the soil while a portion is released back into the atmosphere as carbon dioxide. There are multiple benefits from increasing soil carbon, soils with high organic carbon content are healthier, more productive and have higher water-holding capacity.

Sequestration activities are subject to permanence obligations. This means that if an ACCU is produced through sequestration, the increase in carbon must be maintained for the nominated permanence period (either 25 or 100 years). Permanence should be considered as part of the risk management strategy for any sequestration project considering the impacts and likelihood of fire, drought, and the need to sell that parcel of land.

There are several current vegetation methods all varying in the situations where they are applicable, the activities that can be undertaken and the measurement or calculations of abatement that are applied. In general terms, abatement is calculated by measuring the change in the amount of carbon stored in a project area through the growth of trees, natural decay, and disturbance events (fire, pest, disease, and storm) minus the emissions resulting from fire and fuel used to establish and maintain the project.

Clearly, some of the available activities are not applicable to the SA pastoral zone (such as replanting trees). Others may not be economically viable today even when considering the economic return from the carbon credit combined with the increased return from improved productivity until the cost of participation is reduced, or the value of carbon sequestered is much higher than today's rates. Initial assessment of the applicability, feasibility and economic returns indicates that the most suitable method for the SA pastoral zone is the *Human Induced Regeneration (HIR) of a Permanent Even-Aged Forest* method.

Human Induced Regeneration (HIR) of a permanent even-aged native forest

The most applicable method for the SA pastoral zone is a vegetation method that focuses on land managers undertaking activity that promotes the growth of native forest. This method is the subject of the economic calculation outlined subsequently in this report.

The HIR method is for projects that include one or more of the following human-induced regeneration activities:

- Excluding livestock and taking reasonable steps to keep livestock excluded
- Managing the timing and extent of grazing
- Managing feral animals in a humane manner
- Managing plants that are not native to the project area
- Implementing a decision to permanently cease mechanical or chemical destruction, or suppression, of native regrowth

In general terms, the number of ACCUs issued is calculated by measuring the change in the amount of carbon stored in a project area through the growth of trees, minus the emissions resulting from fire, disturbance events (such as pest, disease, and storm), natural decay and emissions generated in establishing and maintaining the project.

If the activity involves excluding livestock and taking reasonable steps to keep livestock excluded, the livestock must be prevented from grazing in the carbon estimation area until the regenerated vegetation meets the definition of 'forest cover'. Once forest cover is achieved through regeneration, the participant may conduct the human-induced regeneration activity of managing the time and extent of grazing and then allow livestock in the carbon estimation area.

If the activity includes the management of the timing and extent of grazing in a carbon estimation area, grazing may be permitted only to the extent that it does not impact the accumulation of carbon in the carbon estimation area.

Soil carbon sequestration in grazing system

This method involves a project storing carbon on grazing land by increasing inputs of carbon to the soil, reducing losses of carbon from the soil, or both. This is achieved by land managers implementing a range of management actions to build soil carbon. New management actions could include:

- Converting from continuous cropping to pasture
- Undertaking pasture cropping
- Managing pasture by:
    - implementing or changing pasture irrigation
    - applying organic or synthetic fertiliser to pastures
    - rejuvenating pastures, including by seeding
- Managing grazing by:
    - changing stocking rates, or
    - altering the timing, duration and intensity of grazing.

Before the project can commence, the project area needs to be identified and defined. This involves establishing one or more carbon estimation areas and exclusion areas (if applicable). The boundaries of a carbon estimation area must be defined in accordance with the Carbon Farming Initiative (CFI) mapping guidelines and the CFI soil sampling design method and guidelines.

The levels of carbon stored in the soil are estimated regularly throughout the project, based on soil samples taken from various locations. A sampling plan must be prepared that identifies the locations and all samples must be collected and prepared by qualified technicians, and the samples must be analysed by accredited laboratories.

In addition to the general monitoring requirements of Part 17 of the *Carbon Credits (Carbon Farming Initiative) Act 2011*, the method sets out specific monitoring requirements. These include monitoring:

- 'risk of reversal' events (such as if the carbon estimation area is subject to a fire or other event that reduces surface vegetation cover below 40 per cent)
- known erosion events.

There is significant interest in the potential for soil carbon projects across the Australian rangelands. While sequestration rates are generally low, there is a large land area for activity, therefore providing the opportunity for substantial abatement. Concurrently, there are significant production advantages from increased soil carbon due to increasing the productive capacity of the soil including increased water holding capacity.

Unfortunately, at this time, the significant cost in establishing projects, undertaking the required soil sampling at a suitable scale, monitoring project delivery and change, and managing for risk of reversal, all combine to make soil carbon projects currently non-viable in the SA pastoral zone.

Emissions avoidance methods

There are several emissions avoidance methods available for application in agricultural industries. Many of these focus on more intensive production systems where inputs (such as fertiliser) can be reduced or changed, or technology (such as containing methane in effluent ponds) can be implemented. There is one method of interest for the extensive pastoral zone, which is focussed on improving herd management to reduce the CO_2e emissions per kilogram of beef turned off. In short, generating an ACCU through increasing productivity efficiency.

Beef cattle herd management

The beef cattle herd management method includes activities such as the provision of supplements for livestock, installing new fences, planting improved pastures, improving herd genetics, increasing density of water points, changing grazing practices and more intensive stock management.

It is critical under this method (as it is for others) that the project activity is a practice that was not carried out during the set historical period preceding the project and that the activity is legally permissible. Participants can conduct other activities to reduce emissions intensity, but they must meet the requirements of the method and during project registration proponents will need to demonstrate how the proposed activity will result in reduced emissions intensity.

Enterprise records and data from the preceding period is used to estimate emissions intensity and calculate baseline emissions. The project baseline is an estimate of the emissions that would have occurred had a project activity not been implemented.

Baseline emissions are calculated for the herd each year and are essential for calculating the project abatement, and a specified herd emissions calculator has been developed for the purpose. Scheme participants must keep records for seven years according to the general record-keeping requirements of the Act and rules, including:

- separate and self-contained records for each herd, for example:
    - records of yearly liveweight gain
- movements of cattle in and out of the herd with liveweights at entry into and exit from herd, and
- records showing the business structure, location and management changes in the emission intensity reference period.

The method also states that records must be kept for all purchased feed if the project activity involved a change to the herd’s diet and some or all of the feed was purchased.

The beef cattle herd management method has increasing interest across the rangelands. The substantial overlap between actions to drive reduced emissions and increased productivity make this an attractive proposition for increasing the economic sustainability of pastoral enterprises. The increased financial return may remove a significant barrier to land managers being able to implement the practices they aspire to.

However, there are substantial impediments to the implementation of this method. Despite its attractiveness to graziers only seven projects have been registered across Australia and two have since been revoked. Of the five remaining projects only two have generated credits and these projects are delivered by two of the nation's largest beef cattle producers, Consolidated Pastoral Company and Paraway Pastoral.

The size of the herd required to economically deliver the method and the historical record keeping requirements, excludes most pastoral producers and until there are improvements to the method to reduce the herd size required, it is unlikely that this method will be viable for SA pastoral producer. However it is likely that future improvement in the method will increase its utility and applicability for producers with smaller herds. Alternatively, there may be an opportunity for carbon service providers to create a more innovative approach to aggregation to allow for many “small” participants to join in a project with administration, project overheads shared across all participants, with focussed planning and implementation undertaken at the property level.

Section 4: Economic potential of carbon sequestration in SA pastoral rangelands

A “bottom up approach” to assessing the biophysical potential of carbon farming in the SA pastoral zone has been undertaken for this report. This approach is finely scaled and focussed on local conditions, producing results that can be compared with alternative approaches, to help to determine what the likely potential values may be.

These locally scaled outputs have then been applied to a realistic pastoral production model to test how HIR projects, if applied, could impact the whole of enterprise economics.

The development of an economic model for assessing the role of regenerative agriculture in the SA pastoral rangelands requires two elements to be considered:

- the biophysical characteristics of the land
- the current economic utilisation of the land

Here we describe the two model elements separately, then present the outcomes of integrating the two model elements.

Biophysical analysis

There are several potential approaches to determine the carbon sequestration potential of SA pastoral leasehold managed rangelands. This report provides a “high-level” assessment that provides a generalised view which enables all stakeholders in the region to gain an understanding of what the low-carbon economy may mean for them. It is possible to provide a highly-detailed, site-specific assessment for an individual enterprise or pastoral lease. However, this report and associated fact sheets are being prepared for a broad and general audience and so the spatial scale we have investigated here is “large” and at the scale of land systems to make the outputs of the report as broadly applicable as possible.

In short, we have:

- Ranked the land systems of the region as to whether they were “high”, “moderate” or “low” potential to achieve the requirements for a forest, as determined by the HIR method (i.e. forest canopy of 2m height, and at least 20% crown cover at maturity) - the “HIR potential layer”
- Overlaid these “HIR potential layers” on a landscape productivity index that integrates the remote sensing product normalised difference vegetation index (NDVI), soil fertility, vapour pressure deficit, soil water content, and temperature
- Produced a final map that presents a “state-wide” view of which land systems have good potential (classified as moderate or high potential) to regenerate forest carbon stocks if management and conditions are eligible to apply the HIR methodology, and the relative differences in carbon sequestration potential across the region
- Provided a table of the land systems found in the region, with indication of the HIR potential of those land systems, and the total area of those land systems within the SA pastoral rangelands.
- Generated the potential average annual carbon yields (tonnes of CO_2e) over the assumed 25 years of a HIR carbon project for the 60 largest land systems (each covering a minimum of 200,000 ha) within the SA pastoral rangelands.

This set of outputs will assist policy makers and pastoralists to form a view on the potential of their land to support a viable HIR carbon project and whether a more detailed investigation is warranted. For other stakeholders, these outputs will enable them to determine the relative magnitude of risks and opportunities that may come from the application of the HIR method, and the potential for other methods to be of relevance into the future. The results of the initial state-wide carbon potential map are presented in Figure 5.

The approach taken was to randomly select model points within each land system that is over 200,000 hectares of total area (e.g. widely representative land systems within the region). These model points are identified in Figure 5. For each model point, a 25-year forward forecast of carbon yield was determined by applying the FullCAM guidance as required under the HIR method. For each land system, we simply “scaled up” from the model point to the whole land system by multiplying the year over time by area for areas between 10% and 30% of the total land system being able to participate as HIR projects. The total state-wide potential benefit was determined by the summed potential over the same time periods.

To carry out the analysis at this scale several assumptions are required including:

- the relative percentage of potentially eligible land (e.g 10 years baseline prior to project start with no forest cover, and regeneration potential) exists in those land systems
- the model commencement date is “today” (which is likely to be conservative, in that there is reasonable evidence in the field of regeneration occurring in the region)
- that only the HIR method is applied (not testing possible positive effects of applying the existing beef cattle herd management method, and ignoring potential for “whole of rangelands carbon storage method” to be developed in time)
- No sequestered carbon was lost to fires/fire management plans are in place

Potential economic valuation of HIR projects at the whole of SA pastoral rangelands scale

The whole of SA pastoral rangelands assessment was based on 60 “large” (>200,000 hectare) land systems that had “high” or “moderate” potential to achieve “forest cover” from a current condition of “non-forest” (Table 1). This covered a total area of around 34 million hectares (Table 1).

- If we assume that 10% of the assessed area was able and participated in HIR projects, the result would be around 35 million carbon credits created over a 25-year project lifetime. This gives an annual average of just over 1.4 million carbon credits created valued at $28M (at average long run market price of $20/tCO2e) in SA rangelands per year from HIR projects alone.
- If we assume that 20% of the assessed area was able and participated in HIR projects, the result would be around 69 million carbon credits created over a 25-year project lifetime. This gives an annual average of just over 2.8 million carbon credits created value of $56M (at $20/tCO2e) in SA rangelands per year from HIR projects alone.
- If we assume that 30% of the assessed area was able and participated in HIR projects, the result would be around 104 million carbon credits created over a 25-year project lifetime. This gives an annual average of just over 4.2 million carbon credits created valued at $84M (at $20/tCO2e) in SA rangelands per year from HIR projects alone.

Figure 5: *Relative carbon productivity ("M"- is a dimensionless number that represents the maximum potential biomass accumulation for a given hectares, based on underlying soil, rainfall and vegetation assemblage in the absence of management) of the SA Pastoral estate based on data provided by the Australian Government, and averaged on a sub-regional basis. Black triangles indicate model point locations where FullCAM models were run.*

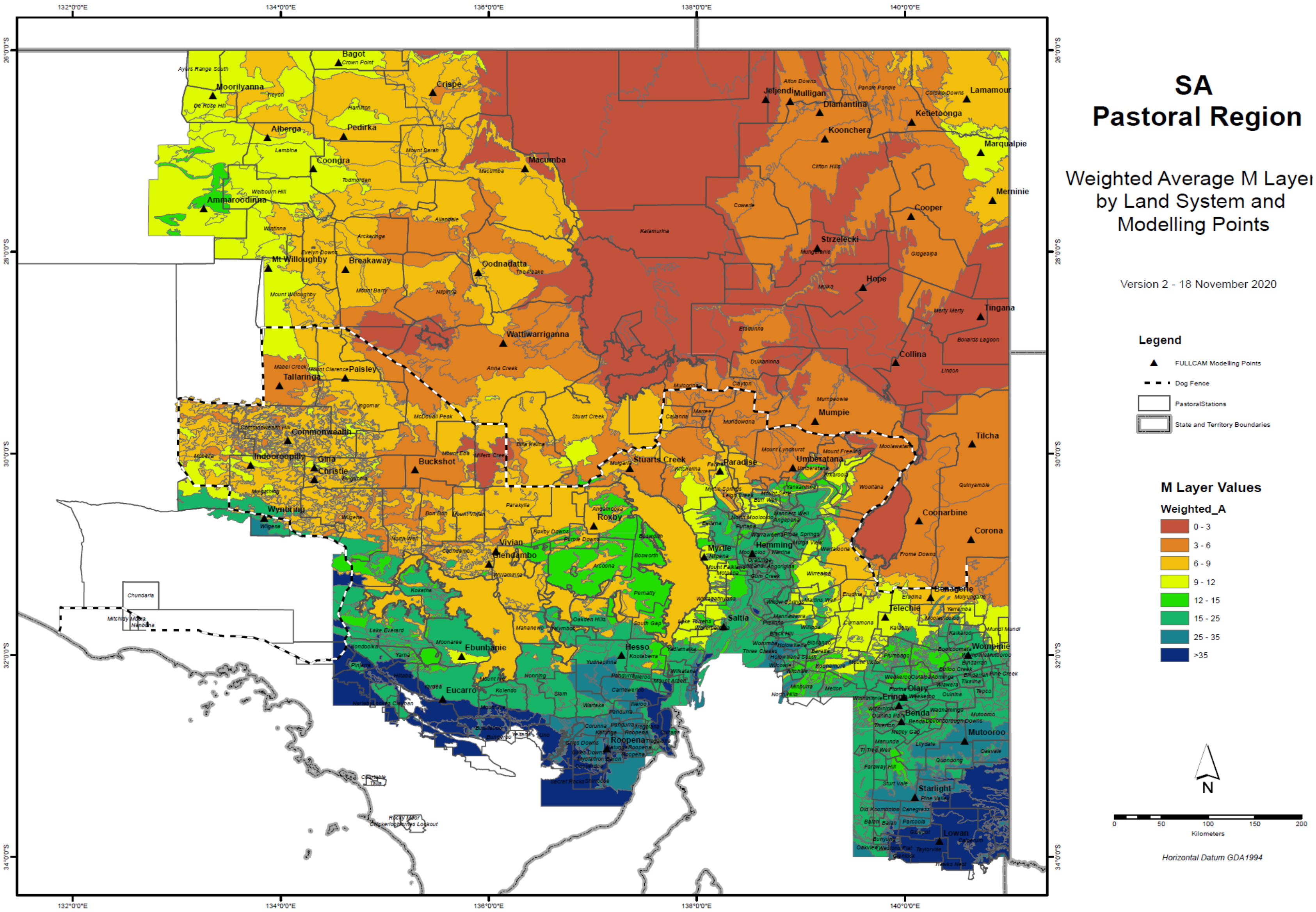


***Table 1**: Summary of FullCAM modelling outputs for selected land systems. "All land systems" are the 60 land systems that were rated as "high" or "medium" carbon potential, with an area >200,000 hectares. Full details of all model outputs for all modelled land systems provided at Appendix 2. Assumptions have been made that show all areas meet the necessary criteria including baseline condition for the HIR method.*

Land system	Area (ha)	tCO2e all land system at 10% HIR @25 years	tCOe2 all land system at 20% HIR @25 years	tCO2e all land system at 30% HIR @25 years
All modelled	**34M ha**	**34,905,112**	**69,810,225**	**104,715,337**
Annual average tCO2e		**1,396,204**	**2,792,409**	**4,188,613**

This model is simply a "production potential" assessment. It is essential to understand what the "cost of production" of these credits might be. This report now turns to examine what the net cost of participation might be for rangelands pastoral enterprises, so pastoralists who are considering a carbon project can begin to get a clearer picture of what the "cost of production" might be in their enterprise.

These estimates are considered to be conservative, as the modelling commencement date was the same as project start date, which could reduce as much as 20% off the carbon sequestration rates achieved over a 25 year project life, depending on when regeneration has actually started.

Professor Ross Garnaut's review[23] of SA's climate change challenges and opportunities, identifies the importance of, and the importance in, increasing the amount of carbon stored in sea, soil and plants as part of the roadmap that supports the targets to getting SA carbon neutral by 2050.

The opportunity to sequester carbon in its land and sea is unusually large in Australia, given larger areas of land per capita compared to most developed countries, and the special qualities of plants which have adapted to Australia's dry and variable climate. South Australia, being the second least densely populated state, has more than its share of the opportunity.

Professor Garnaut identifies a range of additional benefits that come from managing carbon in soil beyond removing carbon from the atmosphere, including:

- retention of water in soil
- enhancement of productivity and fertility from the land
- reduction of methane emissions from livestock
- development of new industries and employment for post pandemic economic recovery

Importantly, Garnaut states, carbon sequestration in the landscape can be a large source of employment and support for re-fuelling the post pandemic economy, similarly to how government funded plantation estates to support South Australia through the Great Depression.

Professor Garnaut asserts that carbon from South Australia, if sold at the true economic value, may be the most valuable commodity in rural South Australia and that investing to build this future will be helpful to post-pandemic growth in jobs and incomes.

[23] Professor Ross Garnault, 2020, South Australia's climate change Challenges and Opportunities, https://www.environment.sa.gov.au/files/sharedassets/public/climate-change/south-australias-climate-change-challenge-opportunity-rgarnaut-rep.pdf

The production potential and economic values identified through this analysis are inside the estimates provided by Garnaut however our modelling used only the existing HIR method, where the Garnaut paper looked at whole rangelands carbon storage.

Economic assessment: property scale

The biophysical analysis of the SA pastoral land systems, as described above, was then used to develop three whole-of-business case studies of pastoral enterprises to examine the potential financial and economic impacts of HIR carbon projects.

It is critical to note, however, the type of land systems on individual properties will influence the carbon potential of the property, and the condition of the land system relative to "pristine" also needs to be determined to work out the feasibility of running a carbon project on the property. The viability of developing and operating a carbon project on your property will always require looking at the current financial and economic status of your enterprise.

In developing these case studies, several overarching assumptions were required:

- that carbon sequestration is permitted under the *Pastoral Land Management and Conservation Act 1989* and all required Eligible Interest Holder Consents (EIHC; e.g. mortgage holder, Crown and any native title holder) are in place
- the carbon credit revenue is directed back to the pastoralist after sale
- pastoral production remains the primary purpose of each property. While some reduction in stocking rates may be required for a period of time to kick-start regeneration of the tree and shrub layer and commence the carbon sequestration process, the intention is not to remove livestock from the rangelands as part of a regenerative approach
- the HIR project is registered and operated according to the requirements of the Clean Energy Regulator as outlined in the relevant legislation and method determination.

The three case studies were developed covering the main livestock enterprises in the pastoral area of South Australia, namely:

- Beef cattle
- Meat sheep
- Merino wool sheep

For each of these enterprises, a region, a representative station, and an associated land system were selected from which to build the financial model. For ease of calculation, each station was assumed to comprise one land system only. In reality, a property may consist of multiple land systems (depending on size and location) and a detailed assessment of project viability will be needed for each property to determine the best approach and likely outcomes.

Current business performance was modelled over a 25-year period to form a base against which the implementation of a HIR carbon project was compared against. This base model is referred to as "business as usual" (BAU). The crediting period of the project is 25 years, and there is a requirement to maintain the carbon for a 100-year permanence period (i.e. 75 years after the crediting period ends). There is an alternative crediting permanence period of 25 years from project first credit issuance, but that requires the project only receiving 75% of the model predicted carbon credits (i.e. the cost of only having a 25-year permanence period is the project receives significantly less credits than it sequesters). We have not examined the impact of the 25-year permanence period option on project viability in this initial study.

In establishing BAU, the impact of seasonal variability, across six user-defined seasonal types (ranging from several bad years in a row through to several good years in a row), was applied to carrying capacity, productivity (reproduction, mortality, weights of meat and wool), management, prices, and costs. These six seasonal types were then used to form a realistic and representative 25-year seasonal sequence for the SA pastoral zone. The same seasonal sequence was applied to the three case study stations. This characterisation of seasons has been confirmed through discussions with SA pastoral zone land managers.

The financial model, which takes a whole-of-business approach that commences with the current stock numbers, then uses the defined productivity, management and carrying capacity across the various seasonal conditions to predict:

- livestock numbers
- stocking rates
- productivity
- income
- costs
- cashflow
- profitability
- assets
- liabilities and
- a range of Key Performance Indicators (KPIs), on an annual basis.

Carrying capacities in Dry Sheep Equivalents (DSEs) or Large Stock Units (LSUs) were defined by the landholder for each land system across the six seasonal conditions. The model ensuring that stocking rates do not exceed carrying capacities; excess stock being sold based on management practices for that particular business. We assume that there is complete control over non-domestic grazing pressure. To achieve this outcome, management plans would need to be in place to exert control over non-domestic grazing animals, not just that of domestic livestock (including overabundant native species as well as feral species).

The BAU projections over 25 years formed the base against which to compare different amounts of the station being allocated to a HIR carbon project, which consisted of a single land system. The three areas assumed were 10%, 20% and 30% of the total station area. These percentages were selected for HIR project areas as experience in other States with very similar land systems and rainfall, together with pre-feasibilities conducted to date in SA, has suggested that it is unlikely for greater than 30% of a property to deliver HIR forest regeneration.

The general location of the stations, which form the basis of these case studies, is shown in Figure 6, with details of the land systems and carrying capacities assumed for each of the representative stations contained within the respective case studies below.

Each of these land systems was selected for use in the case studies as they are representative of a significant portion of land across the SA pastoral rangelands and modelling suggest that they have “medium” or “high” potential of achieving eligible vegetation over the 25-year HIR project period, as per the approved HIR methodology.

The carbon yields for the three case studies are shown in Table 2, to enable readers to compare how the potential carbon yield may vary across different land systems. The carbon yields are also shown in the individual case studies.

Figure 6: *Regions for which HIR carbon feasibility case studies were undertaken.*

Table 2: *Annual carbon yields (tonnes CO2e per ha per year) for the Breakaway, Roopena and Saltia land systems, as predicted by FullCam assuming limited/zero regeneration at project start, likely to result in conservatively low forecasts*

	Carbon Yield (tonnes per ha)		
Year	Breakaway	Roopena	Saltia
1	0.00	0.00	0.00
2	0.00	0.00	0.00
3	0.00	0.00	0.00
4	0.00	0.00	0.00
5	0.02	0.10	0.06
6	0.08	0.38	0.22
7	0.17	0.80	0.46
8	0.26	1.25	0.73
9	0.35	1.66	0.97
10	0.42	1.99	1.16
11	0.48	2.24	1.30
12	0.52	2.43	1.41
13	0.55	2.56	1.49
14	0.57	2.63	1.53
15	0.58	2.67	1.56
16	0.58	2.68	1.56
17	0.59	2.68	1.57
18	0.58	2.64	1.55
19	0.58	2.60	1.53
20	0.57	2.55	1.50
21	0.56	2.50	1.47
22	0.55	2.44	1.44
23	0.54	2.37	1.40
24	0.53	2.31	1.36
25	0.52	2.25	1.33
Average	0.38	1.75	1.02

A set of assumptions were made as a basis for undertaking the financial analysis for the case studies and establishing scenarios for comparison. These assumptions[24] are based on past experience in estimating the activities required to undertake HIR regeneration across pastoral enterprises. The assumptions include:

- A reduction in carrying capacity across the chosen HIR carbon project area, which varies over the course of the project to allow for regeneration of the land and realise the potential to sequester carbon as articulated in Table 2
- Carrying capacity of areas not chosen for HIR remain the same as the base case analysis
- A sequence of seasonal impacts has been utilised, with an influence on the numbers, reproduction, mortality, weights of livestock, prices received, and costs incurred. Livestock numbers in excess of the carrying capacity of the enterprise are sold as per management practices for that business and enterprise.
- The current market price (as of 19th November 2020[25]) of $16.50 per ACCU (1 ACCU = 1 tonne of carbon dioxide equivalent or CO_2e) was applied to the carbon sequestered in the project area, with the landholder credited 70% of this gross income (30% being paid to the project proponent to manage the project, work with the pastoralist to develop a management plan for the project area, undertake all project reporting and auditing requirements and assume permanence risks).

[24] The full list of assumptions is provided in Appendix 4

[25] Market pricing for ACCUs as referenced from Jarden Australia www.accus.com.au

Case Study results: Beef Cattle

A 200,000 ha station running a beef cattle enterprise on the Breakaway land system was modelled with BAU compared to the implementation of a HIR carbon project. Carrying capacity ranges from 18,800 dry sheep equivalents (DSEs) or 2,685 large stock units (LSUs) in the best seasonal conditions, down to 5,875 DSEs or 840 LSUs in the worst season. Carrying capacity in a “fair” year was assumed to be 11,750 DSEs or 1,680 LSUs (17 DSE per ha).

Three HIR project areas of differing sizes were compared to BAU:

- 10% of station area (20,000 ha)
- 20% of station area (40,000 ha)
- 30% of station area (60,000 ha)

The average number of ACCUs generated over the 25-year HIR project averaged 0.38 tonnes per ha per year for the Breakaway land system, ranging from 0 to 0.59 tonnes per ha per year, with the peak of 0.59 tonnes realised in year 17 as shown in Table 3.

***Table 3**: Annual carbon yields (tonnes CO2e per ha per year) for the Breakaway land system, as predicted by FullCam assuming limited/zero regeneration at project start, which is likely to cause the forecasts here to be conservatively low.*

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	Avg
Carbon yield (t per ha)	0.00	0.00	0.00	0.00	0.02	0.08	0.17	0.26	0.35	0.42	0.48	0.52	0.55	0.57	0.58	0.58	0.59	0.58	0.58	0.57	0.56	0.55	0.54	0.53	0.52	0.38

The key assumptions made in establishing this case study have been documented in Appendix 4, while details of beef enterprise productivity, management, land carrying capacity, costs and prices, asset values etc have been based on a representative station within the study region.

The 4 scenarios (BAU, 10%, 20% and 30% of the station being applied to a HIR carbon project) were modelled over the 25-year period and the outcomes compared. A large number of outputs and business Key Performance Indicators (KPIs) can be used to compare BAU with the various carbon scenarios and pastoralists should select the outputs and KPIs which best inform them of the financial and economic impacts of HIR carbon projects on their station. The outputs which may be of most interest to landholders and which are included for comparison purposes in this case study are:

- Cash flow - annual and cumulative
- Average profit (EBIT - Earnings before Interest and Tax) per ha per year
- Average Return on Capital Managed per year
- Cattle Gross Margin per ha
- Net carbon income per ha

These outputs are summarised in Table 4 overleaf.

Table 4. *Enterprise and business indicators for a 200,000 ha beef cattle enterprise on the Breakaway land system, comparing BAU with three HIR carbon projects of different sizes.*

		HIR Project Area (ha)		
Output (averages per year across 25 years)	**BAU**	**20,000**	**40,000**	**60,000**
LSU per year	1,576	1,500	1,420	1,336
Gross Margin per ha - cattle	$1.40	$1.33	$1.26	$1.18
Net carbon income per ha (over 200,000 ha)	$0.00	$0.44	$0.89	$1.33
Annual cash surplus	$25,553	$119,209	$210,894	$303,230
Difference in annual cash flow from BAU	$0	$93,656	$185,340	$277,677
Profit (EBIT) per ha	$0.67	$1.12	$1.56	$2.00
Return on Capital Managed	2.79%	4.05%	5.00%	5.75%

Beef cattle enterprise outputs:

- The Gross Margin per LSU of $177.21 remains constant across all scenarios
- The average number of LSUs on the station declines as the HIR carbon project area increases due to periods of reduced stocking rates in the project area as per the management interventions described in the assumptions. The cattle Gross Margin per hectare therefore decreases in line with the reduction in overall stocking rate.

Whole-of-business outputs:

- Net carbon income on the HIR project area is $4.39 per ha as per carbon yield and price assumptions. Averaged over the full 200,000 ha of the station, the net carbon income ranges from $0.44 per ha when the HIR carbon project forms 10% of the total station area, up to $1.33 per ha when the HIR carbon project area is 30% of the station area.
- The average annual cash surplus for BAU is $25,553 increasing to $303,230 with 30% of the station under a HIR project. Over 25 years, this results in an additional $6,941,925 cash being generated by the business compared to BAU (Figure 7 below).
    - Note that this cash flow does not include investment in station development which may be required to implement a HIR project (e.g. fencing and waters) nor any personal drawings. While tax has been deducted via a simple formula, pastoralists need to make adjustments for their unique business structures and circumstances.
    - It is also important to note that carbon income does not start to have a significant impact on annual cash surplus until Year 8, assuming that there is negligible regeneration in place at project start date. This lag in carbon cash flow has implications on a landholder's ability to finance any station development costs required to implement a HIR project and must be taken into consideration when assessing the viability of a HIR project.
- Profit (EBIT - Earnings before interest and tax) increases from $0.67 per ha for BAU to $2.00 per ha when 30% of that station area is under a HIR project.
- Return on Capital Managed (EBIT as a percentage of the market value of all assets) increases from 2.79% for BAU to 5.75% when 30% of total station area is under a HIR project. Note that the value of assets under management increases with the carbon scenarios due to accumulating cash, hence Return on Capital Managed appears lower than expected.

This case study uses the current market price of $16.50 gross per ACCU across the 25-year project life.

Table 5 below shows how average carbon income per ha per year, based on modelled yields for the Breakaway land system (average of 0.38 tonnes per ha per year) is impacted by changes in price; from the current market price falling 50%, to the forecast 2025 and 2030 prices as provided by Market Advisory Group (October 2020 report).

The current market price per ACCU of $16.50 gross, results in net carbon income per ha (after 30% project management fees) of $4.39. If the price were to increase to $26.98 per ACCU in 2025, net income per ha would increase to $7.18. Conversely a halving of the current market price would result in net carbon income per ha falling to $2.19. For the net income per ha for a HIR project to equal the profit per ha from the beef cattle enterprise in this case study, the carbon price would need to fall below $2.52 per ACCU.

For any financial analysis to be robust, the sensitivity of the predicted outcomes of a HIR project to movements in the carbon price must be considered, with Table 5 examining just several carbon price possibilities. A pastoralist should seek independent professional services financial advice and not rely on the information provided in this case study.

Table 5: *Net carbon income for the Breakaway land system ($/ha per year) based on the modelled carbon yield of 0.38 tonnes per ha per year and a range of ACCU prices.*

	Gross $ per ACCU	Net carbon income per ha at yield of 0.38 t/ha/yr
50% fall in current price	$8.25	$2.19
Current Market Price	$16.50	$4.39
Forecast price 2025	$26.98	$7.18
Forecast price 2030	$32.42	$8.62

Considerations for Beef Cattle Pastoralists

This case study provides the basis for pastoralists, running an extensive beef cattle enterprise in the north west region of the SA rangelands, to form an initial opinion as to the applicability of a HIR carbon project on their station. If this case study suggests to a pastoralist that a HIR carbon project may be of interest and warrant further investigation, it is imperative that they undertake a similar analysis specific to their land, enterprise, and business.

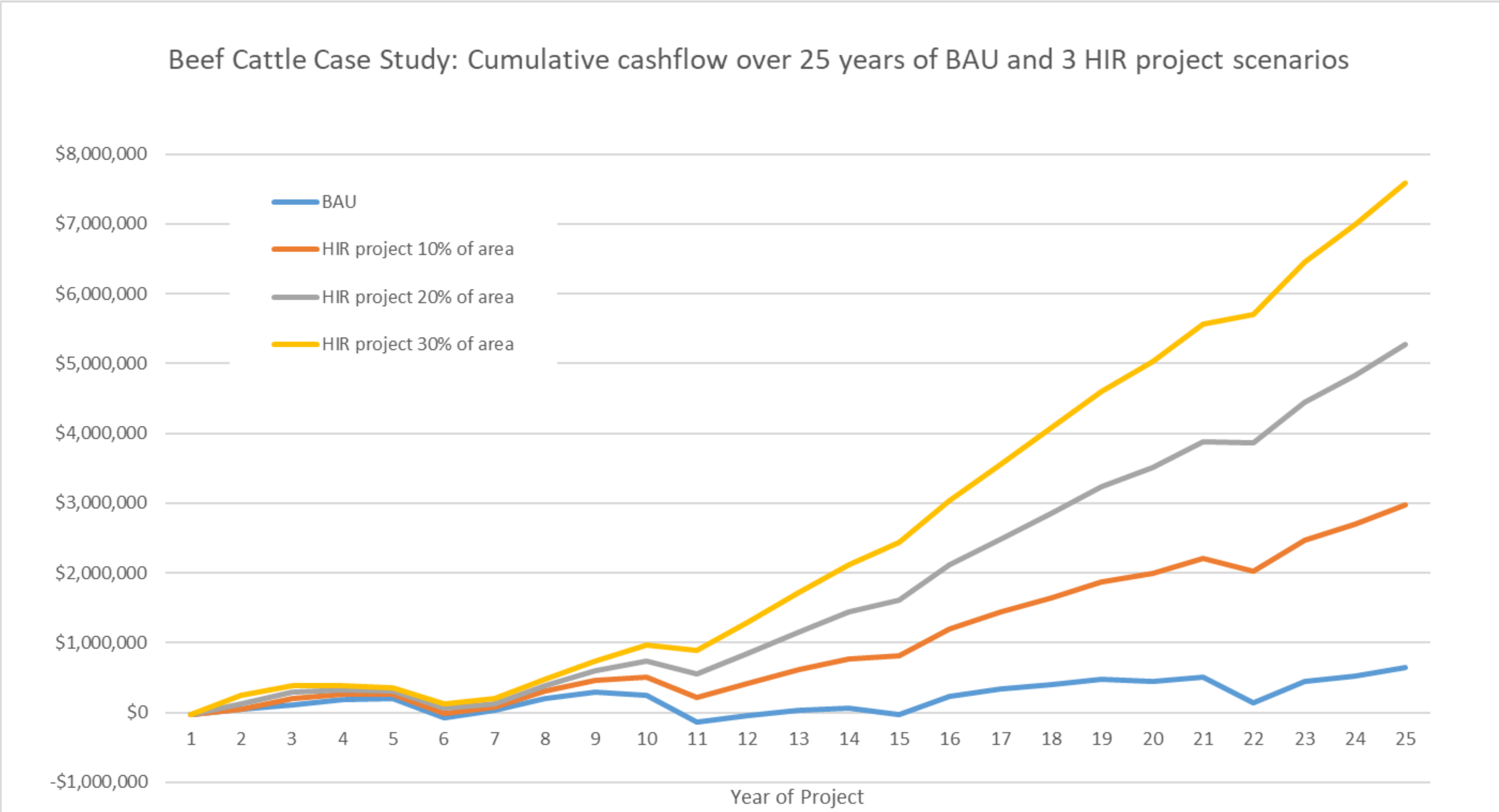
To be in a position to assess the viability of a HIR carbon project, it is essential for the landholder to fully understand the current performance of their business (BAU) and how different seasonal conditions impact carrying capacity of the land, management, livestock productivity, costs and prices. With this information and understanding of BAU, it is then possible to compare alternative management approaches and diversification alternatives such as the implementation of a HIR carbon project.

It is also necessary to understand the potential of the various land systems on the station to sequester carbon and the management interventions (e.g. reduced stocking rates for a period of time) and capital investment (e.g. additional fencing and watering points) required to obtain the predicted carbon yields and meet the requirements of a registered HIR project. With an understanding of BAU, potential carbon yields, management interventions and investment required for development and project implementation, it is possible to form a view as to the carbon price, below which implementing a HIR carbon project may not be viable.

The ability of the business to finance the cost of any station development required to implement a HIR project must be carefully considered, as this case study example shows an 8-year lag between project implementation and significant cash surpluses being generated from carbon sales.

With this thorough approach, an informed decision can be made regarding the potential financial benefits and risks of implementing a HIR carbon project.

Figure 7: *Cumulative cash flow for BAU and the three HIR carbon project scenarios for a 200,000 ha beef cattle station on the Breakaway land system.*



Case Study results: Meat Sheep

A 90,000 ha station running a meat sheep enterprise on the Roopena land system was modelled with BAU compared to the implementation of a HIR project. Carrying capacity ranges from 12,000 DSEs in the best seasonal conditions, down to 7,000 DSEs in the worst season. Carrying capacity in a "fair" year was assumed to be 10,000DSEs (9 ha per DSE).

Three HIR project areas of differing sizes were compared to BAU:

- 10% of station area (9,000 ha)
- 20% of station area (18,000 ha)
- 30% of station area (27,000 ha)

The average number of ACCUs generated over a 25-year HIR project averaged 1.75 tonnes per ha per year for the Roopena land system, ranging from 0 to 2.68 tonnes per ha per year with the peak realised in years 16 and 17 as shown in Table 6.

Table 6: *Annual carbon yields (tonnes CO2e per ha per year) for the Roopena land system, as predicted by FullCam assuming limited/zero regeneration at project start, which is likely to cause the forecasts here to be conservatively low.*

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	Avg
Carbon yield (t per ha)	0.00	0.00	0.00	0.00	0.10	0.38	0.80	1.25	1.66	1.99	2.24	2.43	2.56	2.63	2.67	2.68	2.68	2.64	2.60	2.55	2.50	2.44	2.37	2.31	2.25	1.75

The key assumptions made in establishing this case study are detailed in Appendix 4, while details of meat sheep enterprise productivity, management, land carrying capacity, costs and prices, asset values etc have been based on a representative station within the study region.

The 4 scenarios (BAU, 10%, 20% and 30% of the station being applied to a HIR carbon project) were modelled over the 25-year period and the outcomes compared. A large number of outputs and business Key Performance Indicators (KPIs) can be used to compare BAU with the various carbon scenarios and pastoralists should select the outputs and KPIs which best inform them of the financial and economic impacts of HIR carbon projects on their station. The outputs which may be of most interest to landholders and which are included for comparison purposes in this case study are:

- Cash flow - annual and cumulative
- Average profit (EBIT - Earnings before Interest and Tax) per ha per year
- Average Return on Capital Managed per year
- Merino Gross Margin per ha
- Net carbon income per ha

These outputs are summarised in Table 7 overleaf.

Table 7. *Enterprise and business indicators for a 90,000 ha meat sheep enterprise on the Roopena land system, comparing BAU with three HIR carbon projects of different sizes.*

		HIR Project Area (ha)		
Output (averages per year across 25 years)	**BAU**	**9,000**	**18,000**	**27,000**
DSE per year	9,327	8,800	8,308	7,814
Gross Margin per ha - Meat sheep	$2.94	$2.78	$2.62	$2.47
Net carbon income per ha (over 90,000 ha)	$0.00	$2.02	$4.04	$6.06
Annual cash surplus	$146,792	$347,335	$530,020	$722,881
Difference in annual cash flow from BAU	$0	$200,543	$383,228	$576,089
Profit (EBIT) per ha	$2.69	$4.89	$6.90	$9.01
Return on Capital Managed	4.99%	6.76%	7.86%	8.58%

Meat sheep enterprise outputs:

- The Gross Margin per DSE of $49.38 remains constant across all scenarios
- The average number of DSEs declines as the HIR carbon project area increases due to periods of reduced stocking rates in the project area as per the management interventions described in the assumptions. The meat sheep Gross Margin per hectare therefore decreases in line with the reduction in overall stocking rate.

Whole-of-business outputs:

- Net carbon income on the HIR project area is $20.21 per ha as per the modelled carbon yield and price assumptions. Averaged over the full 90,000 ha of the station, the net carbon income ranges from $2.02 per ha when the HIR carbon project forms 10% of the total station area, up to $6.06 per ha when the HIR carbon project area is 30% of the station area.
- The average annual cash surplus for BAU is $146,792 increasing to $722,881 with 30% of the station under a HIR project. Over 25 years, this results in an additional $14,402,225 cash being generated by the business (refer to Figure 8 below).
    - Note that this cash flow does not include investment in station development which may be required to implement a HIR project (e.g. fencing and waters) nor any personal drawings. While tax has been deducted via a simple formula, pastoralists need to make adjustments for their unique business structures and circumstances.
    - It is also important to note that carbon income does not start to have a significant impact on the cumulative cash position until Year 8, due to the initial reduction in stocking rate and assuming that there is negligible regeneration in place at project start date. This lag in carbon cash flow has implications on a landholder's ability to finance any station development costs required to implement a HIR project and must be taken into consideration when assessing the viability of a HIR project.
- Profit (EBIT - Earnings before interest and tax) increases from $2.69 per ha for BAU to $9.01 per ha when 30% of the station area is under a HIR project.
- Return on Capital Managed (EBIT as a percentage of the market value of all assets) increases from 4.99% for BAU to 8.58% when 30% of total station area is under a HIR project. Note that the value of assets under management increases with the carbon scenarios due to accumulating cash, hence Return on Capital Managed appears lower than expected.

This case study uses the current market price of $16.50 gross per ACCU across the 25-year project life. Table 8 below shows how average carbon income per ha per year, based on modelled yields for the Roopena land system (average of 1.75 tonnes per ha per year) is impacted by changes in price; from the current market price falling 50%, to the forecast 2025 and 2030 prices as provided by Market Advisory Group (October 2020 report).

The current market price per ACCU of $16.50 gross, results in net carbon income per ha (after 30% project management fees) of $20.21. If the price were to increase to the 2025 forecast of $26.98 per ACCU, net income per ha would increase to $33.05. Conversely, a halving of the current market price would result in net carbon income per ha falling to $10.11. For the net income per ha for a HIR project to equal the profit per ha from the meat sheep enterprise in this case study, the carbon price would need to fall below $2.19 per ACCU.

For any financial analysis to be robust, the sensitivity of the predicted outcomes of a HIR project to movements in the carbon price must be considered, with Table 8 examining just several carbon price possibilities. A pastoralist should seek independent professional services financial advice and not rely on the information provided in this case study.

Table 8: *Net carbon income for the Roopena land system ($/ha per year) based on the modelled carbon yield of 1.75 tonnes per ha per year and a range of ACCU prices.*

	Gross $ per ACCU	Net carbon income per ha at yield of 1.75t/ha/yr
50% fall in current price	$8.25	$10.11
Current Market Price	$16.50	$20.21
Forecast price 2025	$26.98	$33.05
Forecast price 2030	$32.42	$39.71

Considerations for Meat Sheep Pastoralists

This case study provides the basis for pastoralists, running an extensive meat sheep enterprise in the SA rangelands, to form an initial opinion as to the applicability of a HIR carbon project on their station. If this case study suggests to a pastoralist that a HIR carbon project may be of interest and warrant further investigation, it is imperative that they undertake a similar analysis specific to their land, enterprise, and business.

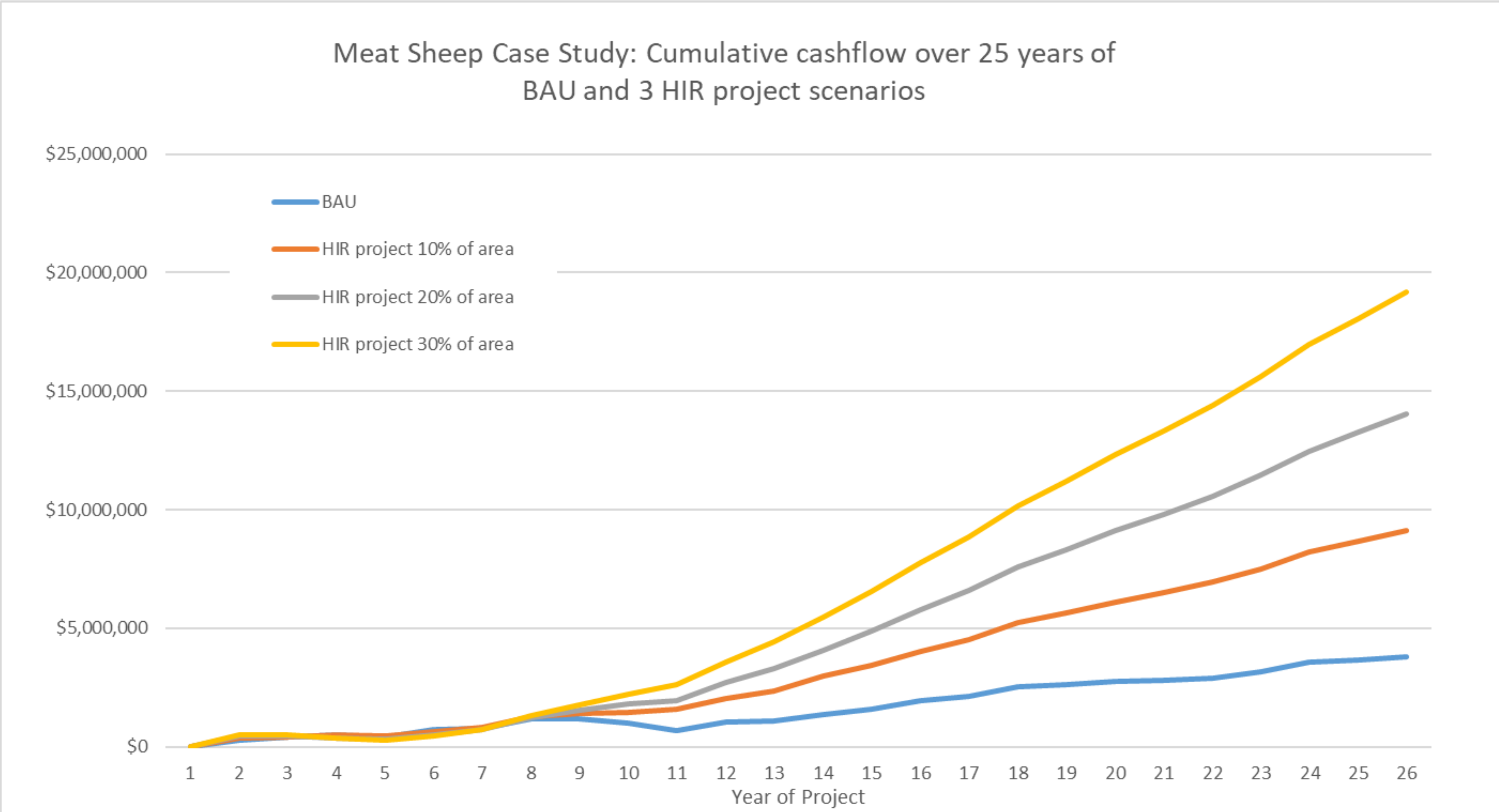
To be in a position to assess the viability of a HIR carbon project on a particular station, it is essential for the landholder to fully understand the current performance of their business (BAU) and how different seasonal conditions impact carrying capacity of the land, management, livestock productivity, costs and prices. With this information and understanding of BAU, it is then possible to compare alternative management approaches and diversification alternatives such as the implementation of a HIR carbon project.

It is also necessary to understand the potential of the various land systems on the station to sequester carbon and the management interventions (e.g. reduced stocking rates for a period of time) and capital investment (e.g. additional fencing and waters) required to obtain the predicted carbon yields. With an understanding of BAU, potential carbon yields, management interventions and investment required for development and project implementation, it is possible to form a view as to the carbon price below which implementing a HIR carbon project may not be viable.

The ability of the business to finance the cost of any station development required to implement a HIR project must be carefully considered. In this case study, it is evident that cumulative cash flow when 30% of the station is under a HIR project takes eight years to be consistently higher than that for BAU.

With this thorough approach, an informed decision can be made regarding the potential financial benefits and risks of implementing a HIR carbon project.

Figure 8: *Cumulative cash flow for BAU and the three HIR carbon project scenarios for a 90,000 ha meat sheep station on the Roopena land system.*



Case Study results: Merino Sheep

A 70,000 ha station running a Merino enterprise on the Saltia land system was modelled with BAU compared to the implementation of a HIR carbon project. Carrying capacity ranges from 10,925 DSEs in the best seasonal conditions, down to 6,650 DSEs in the worst season. Carrying capacity in a "fair" year was assumed to be 9,500 DSEs (7.4 ha per DSE).

Three HIR project areas of differing sizes were compared to BAU:

- 10% of station area (7,000 ha)
- 20% of station area (14,000 ha)
- 30% of station area (21,000 ha)

The average number of ACCUs generated over the 25-year HIR project averaged 1.02 tonnes per ha per year for the Saltia land system ranging from 0 to 1.57 tonnes per ha with the peak annual production realised in Year 17 as shown in Table 9.

Table 9: *Annual carbon yields (tonnes CO2e per ha per year) for the Breakaway land system, as predicted by FullCam assuming limited/zero regeneration at project start, which is likely to cause the forecasts here to be conservatively low.*

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	Avg
Carbon yield (t per ha)	0.00	0.00	0.00	0.00	0.06	0.22	0.46	0.73	0.97	1.16	1.30	1.41	1.49	1.53	1.56	1.56	1.57	1.55	1.53	1.50	1.47	1.44	1.40	1.36	1.33	1.02

The key assumptions made in establishing this case study have been documented in Appendix 4, while details of Merino enterprise productivity, management, land carrying capacity, costs and prices, asset values etc have been based on a representative station within the study region.

The 4 scenarios (BAU, 10%, 20% and 30% of the station being applied to a HIR carbon project) were modelled over the 25-year period and the outcomes compared. A large number of outputs and business Key Performance Indicators (KPIs) can be used to compare BAU with the various carbon scenarios and pastoralists should select the outputs and KPIs which best inform them of the financial and economic impacts of HIR carbon projects on their station. The outputs which may be of most interest to landholders and which are included for comparison purposes in this case study are:

- Cash flow - annual and cumulative
- Average profit (EBIT - Earnings before Interest and Tax) per ha per year
- Average Return on Capital Managed per year
- Merino Gross Margin per ha
- Net carbon income per ha

These outputs are summarised in Table 10 overleaf.

Table 10. *Enterprise and business indicators for a 70,000 ha Merino enterprise on the Saltia land system, comparing BAU with three HIR carbon projects of different sizes.*

Output (averages per year across 25 years)	BAU	HIR Project Area (ha) 7,000	14,000	21,000
DSE per year	9,378	8,885	8,394	7,880
Gross Margin per ha - Merino	$9.17	$8.72	$8.26	$7.77
Net carbon income per ha (over 70,000 ha)	$0.00	$1.18	$2.36	$3.53
Annual cash surplus	$310,532	$370,022	$429,484	$485,804
Difference in annual cash flow from BAU	$0	$59,490	$118,952	$175,272
Profit (EBIT) per ha	$5.74	$6.56	$7.37	$8.14
Return on Capital Managed	5.74%	6.23%	6.67%	7.08%

Merino wool outputs:

- The Gross Margin per DSE of $68.45 remains constant across all scenarios
- The average number of DSEs declines as the HIR carbon project area increases due to periods of reduced stocking rates in the project area as per the management interventions described in the assumptions. The Merino Gross Margin per hectare therefore decreases in line with the reduction in overall stocking rate.

Whole-of-business outputs:

- Net carbon income on the HIR project area is $11.78 per ha as per the modelled carbon yield and price assumptions. Averaged over the full 70,000 ha of the station, the net carbon income ranges from $1.18 per ha when the HIR carbon project forms 10% of the total station area, up to $3.53 per ha when the HIR carbon project area is 30% of the station area.
- The average annual cash surplus for BAU is $310,532 increasing to $485,804 with 30% of the station under a HIR project. Over 25 years, this results in an additional $4,381,795 cash being generated by the business (refer to Figure 9 below).
  - Note that this cash flow does not include investment in station development which may be required to implement a HIR project (e.g. fencing and waters) nor any personal drawings. While tax has been deducted via a simple formula, pastoralists need to make adjustments for their unique business structures and circumstances.
  - It is also important to note that carbon income does not start to have a significant impact on the cumulative cash position until Year 10, due to the initial reduction in stocking rate and assuming that there is negligible regeneration in place at project start date. This lag in carbon cash flow has implications on a landholder’s ability to finance any station development costs required to implement a HIR project and must be taken into consideration when assessing the viability of a HIR project.
- Profit (EBIT - Earnings before interest and tax) increases from $5.74 per ha for BAU to $8.14 per ha when 30% of the station area is under a HIR project.
- Return on Capital Managed (EBIT as a percentage of the market value of all assets) increases from 5.74% for BAU to 7.08% when 30% of total station area is under a HIR project. Note that the value of assets under management increases with the carbon scenarios due to accumulating cash, hence Return on Capital Managed appears lower than expected.

This case study uses the current market price of $16.50 gross per ACCU across the 25 year project life.

Table 11 below shows how average carbon income per ha per year, based on modelled yields for the Saltia land system (average of 1.02 tonnes per ha per year) is impacted by changes in price; from the current market price falling 50%, to the forecast 2025 and 2030 prices as provided by Market Advisory Group (October 2020 report).

The current market price per ACCU of $16.50 gross, results in net carbon income per ha (after 30% project management fees) of $11.78. If the price were to increase to the 2025 forecast of $26.98 per ACCU, net income per ha would increase to $19.20. Conversely, a halving of the current market price would result in net carbon income per ha falling to $5.89. For the net income per ha for a HIR project to equal the profit per ha generated from the Merino enterprise in this case study, the carbon price would need to fall below $8.04 per ACCU.

For any financial analysis to be robust, the sensitivity of the predicted outcomes of a HIR project to movements in the carbon price must be considered, with Table 11 examining just several carbon price possibilities. A pastoralist should seek independent professional services financial advice and not rely on the information provided in this case study.

Table 11: *Net carbon income for the Saltia land system ($/ha per year) based on the modelled carbon yield of 1.02 tonnes per ha per year and a range of ACCU prices.*

	Gross $ per ACCU	Net carbon income per ha at yield of 1.02 t/ha/yr
50% fall in current price	$8.25	$5.89
Current Market Price	$16.50	$11.78
Forecast price 2025	$26.98	$19.20
Forecast price 2030	$32.42	$23.15

Considerations for Merino pastoralists

This case study provides the basis for pastoralists, running an extensive Merino enterprise in the SA rangelands, to form an initial opinion as to the applicability of a HIR carbon project on their station. If this case study suggests to a pastoralist that a HIR carbon project may be of interest and warrant further investigation, it is imperative that they undertake a similar analysis specific to their land, enterprise, and business.

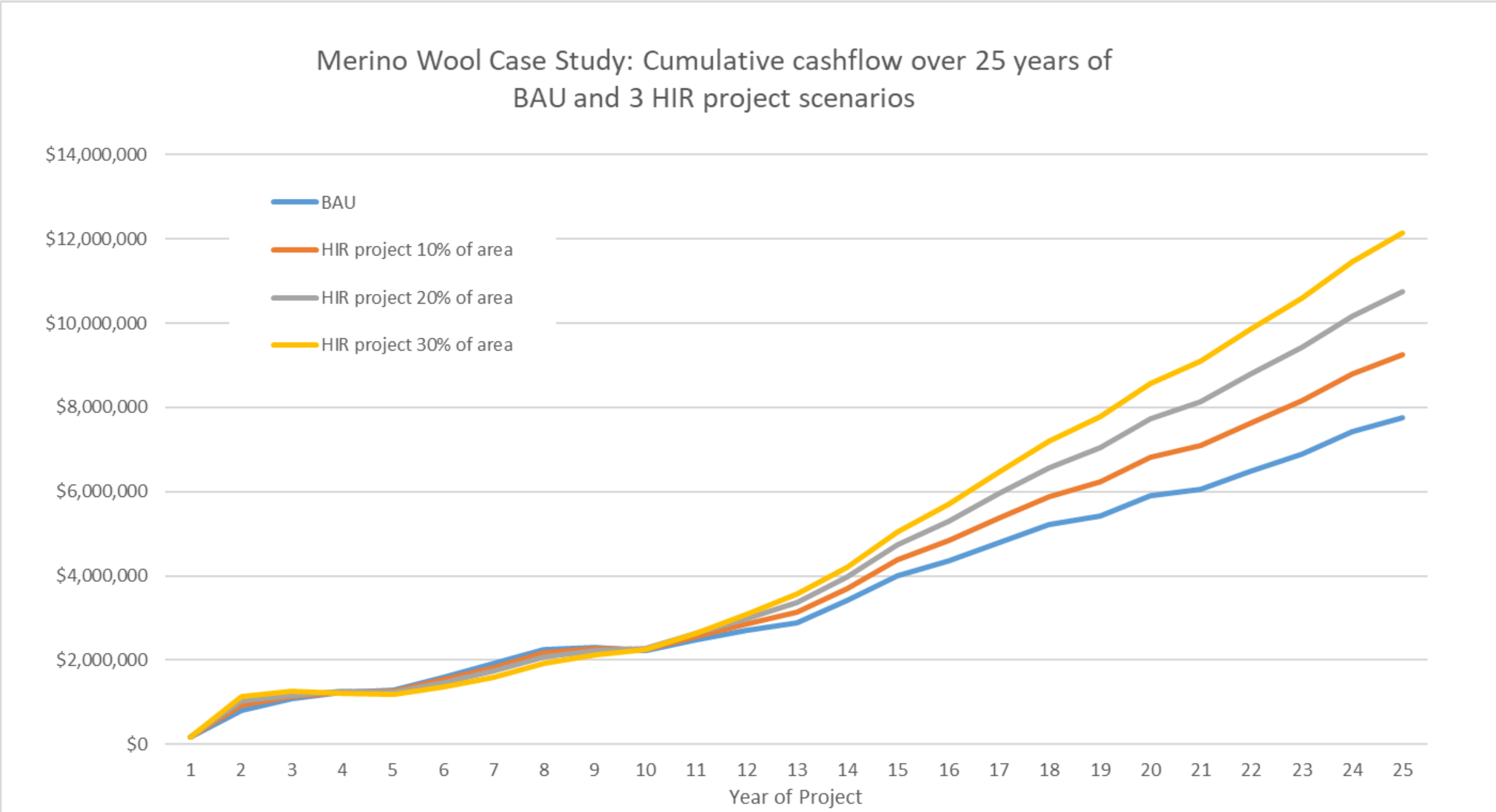
To be in a position to assess the viability of a HIR carbon project on a particular station, it is essential for the landholder to fully understand the current performance of their business (BAU) and how different seasonal conditions impact carrying capacity of the land, management, livestock productivity, costs and prices. With this information and understanding of BAU, it is then possible to compare alternative management approaches and diversification alternatives such as the implementation of a HIR carbon project.

It is also necessary to understand the potential of the various land systems on the station to sequester carbon and the management interventions (e.g. reduced stocking rates for a period of time) and capital investment (e.g. additional fencing and waters) required to obtain the predicted carbon yields. With an understanding of BAU, potential carbon yields, management interventions and investment required for development and project implementation, it is possible to form a view as to the carbon price below which implementing a HIR carbon project may not be viable.

The ability of the business to finance the cost of any station development required to implement a HIR project must be carefully considered. In this case study, it is evident that cumulative cash flow when 30% of the station is under a HIR project takes 10 years to be consistently higher than that for BAU.

With this thorough approach, an informed decision can be made regarding the potential financial benefits and risks of implementing a HIR carbon project.

Figure 9*: Cumulative cash flow for BAU and the three HIR carbon project scenarios for a 70,000 ha Merino station on the Saltia land system.*



Overall summary of financial and economic benefits of HIR carbon projects in the SA pastoral rangelands:

These case studies, based on the predicted carbon yields of the land systems used and the current market price of carbon, show that HIR carbon projects may provide considerable financial benefit to landholders. For these particular enterprises and land systems, carbon appears to provide a higher income per ha than livestock on the areas where HIR projects may be implemented – which is unlikely to be 100% of a property. While it may be tempting to conclude that a business will be more profitable if destocked, or significantly reduced, and the station turned over to HIR carbon projects, the implications of such an approach need to be carefully considered for the following reasons:

1. While some country may require a rest from grazing for a period due to historic overgrazing, the process of restoring land is most effective and efficient with the inclusion of livestock, with evidence to suggest that land deteriorates over time in the absence of well managed livestock due to the lack of plant stimulation and soil disturbance which builds a seed bed and water catchment. Land degradation is not caused by the cow or sheep per se, but rather by how that cow or sheep is managed. If the correct balance of density of hooves and mouths on an area of land and the time that density is applied to the land is achieved, then water holding capacity, vegetation cover, organic matter and carbon content of the soil all increase. With this improved soil environment, vegetation cover increases which in turn improves the carrying capacity of the land, and pastoral businesses become more profitable.
   In short, the best way to improve natural capital asset conditions in the rangelands of SA will require appropriate management of stock, not destocking the rangelands.
2. Without pastoralism in our rangelands, there are less employment opportunities and fewer businesses required to provide inputs and supporting services across the whole supply chain. The result being unsustainable local communities which then lose private and government services; a downward spiral that must be avoided. Additionally, if large areas of rangelands go under HIR projects where the project mechanism is destocking and keeping that land destocked, we lose critical protein and fibre production required to feed and clothe a growing global population.
3. What happens if the carbon price falls below what is anticipated; for a month, for a year, or for a few years in a row? While it may not be in model forecasts, it has happened in the past and this is a risk that must be acknowledged. While there are a variety of mechanisms for managing price risk, the risk possibility of significant falls in the market price of carbon cannot be ignored.
4. Large tracts of land put aside for HIR carbon projects may reduce animal management input, which can result in an increase in populations of feral animals and plants.

The current and future pastoral legislation in South Australia that guides the management, condition and use of pastoral lands in South Australia acknowledges the support and growth of pastoral industry alongside the sustainable management of pastoral lands as core objectives. Work on a new Pastoral Lands Act is underway with a key aim of the new Act to enable sustainable economic resilience for pastoral sector, including supporting alternative land-uses and diversification opportunities such as carbon farming. New policy and guidelines are being developed to enable carbon farming (through HIR method) and will be released soon.

As mentioned in Section 3 of the report, there are other carbon farming methodologies with potential applicability to this region, notably the Beef Cattle Herd Management which aims to achieve a reduction in emissions intensity through an increase in livestock production efficiency. The development of a "whole-of-rangelands" carbon sequestration methodology is currently being considered by government. This method aims to have the carbon sequestered in soils and litter, in addition to trees (via HIR), recognised. These methodologies, with the opportunity for additional income streams for pastoral businesses, will likely not be available if livestock are removed from the rangelands.

Section 5: Engaging in Carbon Farming

How to become involved in carbon farming

The Carbon Farming Initiative and the ERF were designed so that individual landholders could register projects and undertake projects individually, however it is a complex system and a very new area of competence and activity for many people.

Undertaking a carbon project is a business decision with costs and benefits. Like any new business venture, the choice to participate in carbon farming should include a careful consideration of the costs and benefits involved, alongside the risks of the activity being considered. Before deciding to proceed, this should be compared to other activities that could be undertaken within the enterprise. Equally, if the decision is made to not participate, the reasons should be clear, so that if parameters change in the future then the opportunity to capitalise is recognised.

Land managers will need to consider if a carbon project will generate enough income to be worthwhile. Defining the objectives in undertaking a carbon farming project will guide whether it is worthwhile or not. If the primary objective is to generate income and make a profit from a carbon farming project then it should be considered from an economic perspective, including not only the establishment costs of the project but its ongoing auditing, legal and monitoring costs, as well as the potential loss of opportunity to utilise the land in another way.

However, not all decisions are purely financial and considerations such as increased sustainability through diversification, opportunities for succession, alternative land uses for less traditionally productive areas, lifestyle decisions, project co-benefits and personal interest in the products or outcomes being developed, all play a part. Consideration of other potential benefits of a carbon project may play an important role and these may be the difference of whether it is worth undertaking a carbon farming project or not. Considerations could include whether the project contributes to better herd management, better vegetation and biodiversity management and or better soil management. Having a clear understanding of the drivers behind participation in carbon farming will help determine the type of project being developed and its true value to the enterprise.

Participation and the type of project that may be implemented is also significantly impacted by the regulatory requirements of the ERF. This will dictate what activities are eligible on the property and will be a significant driver of whether a particular activity is profitable.

There are many activities that may benefit the landholder and reduce greenhouse gas emissions but are either not recognised by the ERF or are not economically viable.

To be able to participate in carbon farming and generate an Australian Carbon Credit Unit, a land manager must consider and meet two key criteria:

- Do they have the legal right to undertake the project on the property?
- Is there a suitable method?

Additionally, they may wish to consider:

- Does the high-level analysis suggest that it is worth undertaking further investigation?
- Is there a suitable vehicle for participation? This may involve a partnership.
- Financial implications and viability of the project, by undertaking a detailed financial and risk analysis combined with professional advice about the viability of the project.
- The requirements to implement the project, including developing the implementation plan and seek a contract or finance, if needed to support proceeding with the project.

Landowners can directly participate themselves or can do so with the support of a service provider. Similarly, to the consultants and assistance available for other agricultural industries, the Carbon Farming industry has service providers that assist land managers to participate. The most common entry path is for people to partner with a carbon project developer. Project developers may assist at all steps of the process up to the sale of the ACCUs or they may provide support for particular phases of the project development or implementation. Importantly some project developers share the risk of project failure, while others do not.

Before signing with a particular project developer:

- Read the Australian Carbon Industry Code of Practice
- Research the performance of the project developer, speak to people who already have Carbon Projects,
- Speak to multiple project developers, and do not sign with the first offer provided.
- Be aware of the time commitment of the project: if it's a very long-term arrangement, what elements of the contract are going to motivate the carbon project developer to continue to work hard over the whole time frame?
- Look for carbon project developers who will share the risk as well as the rewards
- Be very clear on who is the Project Proponent and any contracting party to a carbon sales agreement, especially one that looks at future delivery of credits
- Ensure the carbon project developer provides you with very clear understanding of the market opportunities that exist for the sale of credits and what you might be giving up in the future if you agree to sign up for long term carbon sales agreements
- Always seek independent legal and financial advice prior to signing an agreement.

Carbon market participation: risk and opportunity

As with any primary production, there is a range of risks associated with the opportunities presented above. The relative level of actual versus perceived risk will differ amongst stakeholders and potential participants. The individual risks are categorised and outlined below as regulatory, project and market risks.

Presently, the challenge of registering and securing carbon assets on the land also comes in the fact that while pastoral leaseholders “own” the lease, the SA Government is yet to release clear guidelines on how pastoral lease holders are able to become a registered CFI project participant under the current Pastoral Act or receive Eligible Interest Holder consent. The State Government, through Department of Primary Industries and Regions and Department for Environment and Water, are working to finalise the advice and guidelines. It’s expected that an application process that will enable carbon farming (through HIR method) on pastoral leases will be released soon.

Further complicating the risk of not succeeding in developing and running carbon avoidance or sequestration projects in the SA rangelands is that in the initial stages of project development and delivery, there is restricted skilled human capacity to assist in developing commercial operations in the field, including the development of robust Quality Assurance / Control models as well as financing project development.

Of course, and perhaps most importantly, as this report has started to indicate, not all areas of the SA rangelands will have significant carbon storage potential, as the carbon storage potential of the landscape is likely to be primarily driven by rainfall (frequency and annual averages) in concert with soil biogeochemistry and plant associations related to these aspects. While the remote sensing data tend to suggest that there will be areas that are “good” and others that will be “less effective” at carbon sequestration, carbon sequestration cannot be considered as the only measure by which we determine the environmental condition or performance of an area of land. There will be a need to determine other integrated measures of environmental performance, including other elements of ecosystem function, including a full range of habitat resources, species richness, genetic diversity, connectivity to other landscape units and “completeness” or “intactness” relative to a “pristine” area of equivalent country, as well as a very low level of occurrence of introduced plants and animals.

Also, there is a potential risk that the modelling and remote sensing data do not accurately reflect the true conditions that are occurring on the land. Further, the lack of data required as input data sets for modelling tools, from the SA rangelands will severely restrict the potential to accurately forecast potential carbon sequestration conditions as a result of changed management conditions which will present a risk to those interested in developing carbon projects.

The activities discussed above are based on currently approved methods, however increased opportunity and financial returns is dependent on the Federal Government or private proponents being able to establish a rangelands carbon storage measurement and estimation methodology that meets the requirements of the Carbon Farming Initiative. This is the subject of ongoing discussion and efforts nationally. However, the risk here is that the cost of measurement sampling intensity required to give a detectable improvement relative to modelled carbon sequestration may outweigh the value of the carbon stored.

It must be also acknowledged that the alternative of doing nothing also carries future risks. At a policy level, without developing a working knowledge of the regulatory and legislative environment at the federal level and failing to engage in the consultation and negotiating phases of this market development could mean that elements of SA’s best interests may not be represented. At an enterprise level, doing nothing may lead to loss of market access, declining financial returns and ongoing impacts on the natural asset.

Sequestration activities are subject to permanence obligations. This means if an ACCU is produced through sequestration, the increase in carbon must be maintained for the nominated permanence period (either 25 or 100 years). Permanence should be considered as part of the risk management strategy, considering impacts and likelihood of fire, drought, and the need to sell that parcel of land.

Managing risk is an everyday part of running a property in the SA pastoral zone. Some risks are easier than others to manage and people have different approaches and tolerances to risk. This is where it is crucial to fully investigate options and have a clear view of the actual risks and how relevant they are to the individual circumstances of the participants.

Land managers can gain a greater understanding of the risks and opportunities through speaking with other land managers involved in carbon farming, contact multiple project developers and carbon service providers, discuss potential issues with industry bodies, and seek support from State government agencies and the SA Arid Lands Landscape Board. Above all else, seek independent legal and financial advice prior to signing any contracts or service agreements.

Appendices

Appendix 1: Australian Government international commitments to reducing greenhouse gas emissions

Kyoto Protocol

Australia made an international commitment in December 1997 at Kyoto (Conference of the Parties COP3) to limit its greenhouse gas emissions growth to 108 per cent of its 1990 baseline, which equates to nearly a 30 per cent reduction from its 'business as usual' projections in the period 2008-2012 (the first commitment period) and 2013-2020 (the second commitment period). [26]

This reduction target also allowed for the accounting of carbon sequestration in the land sector from reforestation that sees an increase in forest cover, where forest is defined[27] as an area with:

- tree crown cover of 20% canopy
- minimum land area of 0.2 hectares, and
- minimum tree height of 2 metres

Paris Agreement

Australia is party to the Paris Agreement. The Paris Agreement came into force in 2016. It builds on ongoing international efforts to address climate change under the:

- United Nations Framework Convention on Climate Change[28] (UNFCCC)
- Kyoto Protocol

The Paris Agreement aims to strengthen the global response to the threat of climate change by:

- holding the increase in the global average temperature to well below 2°C above pre-industrial levels
- pursuing efforts to limit temperature increase to 1.5°C
- Under the Paris Agreement, Australia must submit emissions reduction commitments known as Nationally Determined Contributions (NDCs).

Australia’s first NDC includes an economy-wide target to reduce greenhouse gas emissions by 26 to 28 per cent on 2005 levels by 2030. Australia will submit its next NDC, with a post–2030 target, to the UNFCCC in 2025.

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[26]https://www.aph.gov.au/About_Parliament/Parliamentary_Departments/Parliamentary_Library/Publications_Archive/archive/kyoto

[27] Department of Climate Change, ‘The Australian Government’s Initial Report under the Kyoto Protocol’, Australia’s National Greenhouse Accounts, Submission to the UNFCCC, Commonwealth of Australia, 2008.

[28] https://unfccc.int/

Appendix 2: detailed table of carbon potential of land systems identified in Table 1

Land system	Area (ha)	tCO2e/land system at 10% HIR @25 years	tCOe2/land system at 20% HIR @25 years	tCO2e/land system at 30% HIR @25 years
Alberga	246,030	402,711	805,421	1,208,132
Ammaroodinna	650,024	959,666	1,919,332	2,878,997
Bagot	238,401	266,042	532,084	798,125
Benagerie	216,657	189,090	378,179	567,269
Benda	201,384	515,460	1,030,919	1,546,379
Breakaway	1,221,294	1,170,349	2,340,697	3,511,046
Buckshot	501,055	249,481	498,962	748,443
Christie	423,638	293,977	587,954	881,931
Collina	615,075	37,721	75,442	113,162
Commonwealth	702,704	40,947	81,894	122,840
Coonarbine	440,829	248,841	497,682	746,523
Coongra	573,226	989,279	1,978,559	2,967,838
Cooper	1,542,335	257,538	515,076	772,614
Corona	661,220	510,171	1,020,342	1,530,513
Crispe	403,776	284,149	568,299	852,448
Diamantina	562,395	347,937	695,873	1,043,810
Ebunbanie	930,029	2,196,915	4,393,829	6,590,744
Eringa	404,697	748,014	1,496,027	2,244,041
Eucarro	256,812	1,236,581	2,473,161	3,709,742
Gina	528,004	456,837	913,674	1,370,510
Glendambo	818,392	578,828	1,157,655	1,736,483
Hemming	270,869	999,428	1,998,855	2,998,283
Hesso	369,216	1,206,605	2,413,211	3,619,816
Hope	923,039	131,216	262,433	393,649
Indooroopilly	308,618	329,708	659,416	989,124

Appendix 2: detailed table of carbon potential of land systems identified in Table 1 (cont.)

Land system	Area (ha)	tCO2e/land system at 10% HIR @25 years	tCOe2/land system at 20% HIR @25 years	tCO2e/land system at 30% HIR @25 years
Jeljendi	461,541	40,414	80,828	121,242
Ketietoonga	304,199	45,684	91,369	137,053
Koonchera	931,725	484,387	968,775	1,453,162
Lamamour	572,665	84,916	169,832	254,749
Lowan	379,562	1,928,140	3,856,279	5,784,419
Macumba	373,321	585,552	1,171,104	1,756,655
Marqualpie	226,311	316,478	632,955	949,433
Merninie	203,168	268,470	536,939	805,409
Moorilyanna	486,322	541,252	1,082,505	1,623,757
Mt Willoughby	617,817	566,094	1,132,187	1,698,281
Mulligan	248,978	157,225	314,450	471,676
Mumpie	1,721,237	322,405	644,810	967,215
Mutooroo	228,035	882,655	1,765,310	2,647,965
Myrtle	422,035	597,887	1,195,775	1,793,662
Olary	204,961	380,586	761,173	1,141,759
Oodnadatta	3,604,265	2,983,959	5,967,918	8,951,878
Paisley	654,549	853,194	1,706,388	2,559,582
Paradise	296,638	236,122	472,243	708,365
Pedirka	496,745	792,254	1,584,507	2,376,761
Roopena	318,759	1,393,745	2,787,490	4,181,235
Roxby	762,787	489,525	979,049	1,468,574
Saltia	291,448	745,731	1,491,463	2,237,194
Starlight	296,267	1,215,707	2,431,414	3,647,122
Strzelecki	1,035,938	591,257	1,182,515	1,773,772
Stuarts Creek	380,869	318,940	637,879	956,819

Appendix 2: detailed table of carbon potential of land systems identified in Table 1 (cont.)

Land system	Area (ha)	tCO2e/land system at 10% HIR @25 years	tCOe2/land system at 20% HIR @25 years	tCO2e/land system at 30% HIR @25 years
Tallaringa	240,908	158,967	317,934	476,902
Telechie	364,900	413,578	827,156	1,240,734
Tilcha	780,046	379,324	758,648	1,137,972
Tingana	1,222,597	408,216	816,432	1,224,648
Umberatana	241,352	80,141	160,281	240,422
Vivian	474,683	378,322	756,644	1,134,966
Wattiwarriganna	863,207	352,115	704,230	1,056,344
Wompinie	245,111	627,263	1,254,526	1,881,789
Wynbring	268,925	637,119	1,274,239	1,911,358
Total	**34,231,590 ha**	**34,905,112**	**69,810,225**	**104,715,337**

Appendix 3a: regulatory related risks to carbon farming project

Source	Impact (Consequence X likelihood)	Mitigation strategy
Revocation of primary legislation	Catastrophic for project, unlikely	Ensure project management plan consistent with land management objectives, maintain visibility of alternative markets (enviro offsets, natural capital)
Regulatory: Project Proponent obligations	Catastrophic for project, possible. Obligations of role of "Project	Ensure the right party is undertaking the responsibilities of project proponent. Ensure the party operating as Project Proponent has full understating of legal responsibilities and consequences. Ensure party operating as Project Proponent is suitably prepared (includes carbon sequestration obligations over permanence period)
Major change to method	Low for project (if conservative estimations of area), possible	Ensure conservative approaches to abatement estimation are made, apply best practice and innovative techniques based on sound scientific methods of assessment. Maintain close linkages between carbon reporting and science/innovation in agency
Poor standing with Clean Energy Regulator	Moderate for project, possible	Maintain frequent communications with CER, ensure all reporting and responses are of high quality and timely delivery, ensure all audits pass unqualified.
Regulatory: FullCAM forecast and issuance differs	Serious for project, possible	Field test and calibration of carbon estimation area development as early as possible in feasibility study process (using pre-feasibility to get view of opportunity, then detailed feasibility study to confirm likely volume with high degree of confidence)
PP not having adequate SOP, process, trained & skilled staff to pass systemic audit	Ensure Standard Operating Procedures, processes and work systems are Code of Conduct Compliant and pass systemic audit	Full Compliance with Code of Conduct
Long timeframe to reach decision to register project	Serious for project scale, possible. Delays in dealing with risks and project proponent responsibilities lead to delay in registration, meaning potentially eligible land cannot participate.	Rapid and clear focus on identifying risk and opportunity; undertake gap analysis between current capability and regulatory and market demands/requirements.

Appendix 3b: project related risks to carbon farming project

Source	Impact (Consequence X likelihood)	Mitigation strategy
Underestimation of baseline area, overestimation of eligible area	Serious for project, unlikely	Ensure conservative approaches to abatement estimation are made, apply best practice and innovative techniques based on sound scientific methods of assessment
Fire in eligible area	Serious for project, possible	Development of fire management plan for project area, including sacrificing small amounts of eligible areas as fire breaks to reduce risk; use of timed stock grazing to reduce fuel load/fire break development. Holding appropriate volume of insurance ACCUs (actuarial study of likelihood of loss)
Carbon permanence obligations; general risk	Serious for project, possible	Management plan in place; withhold credits from sale (insurance buffer held), selection of 25-year permanence period. Management plan in place to protect vegetation or to see recovery in event of loss. Project Proponent aware of risk and has mitigation in place, through understanding of legislation.
Land management regimes need to be undertaken to cause regeneration	Serious for project, possible	Careful examination of factors and conditions that allow regeneration; feasibility study to examine vegetation types and likelihood of regeneration occurring; likely management requirements to trigger and support regeneration transition to forest; ensure budget availability and local resources on hand to deliver required management regime (including firefighting and fire risk management).
Inappropriate grazing regimes impact eligible area	Serious for project, possible	Testing and refining agreed management plan; spot checks of implementation, testing to see correlation between control efforts and recovery; checking impact of overabundant native and feral grazing. Need to ensure management plans seek to have the fence line established and maintained. Regular comms with neighbours with stock. Site manager awareness and compliance with management plan/vigilance.

Appendix 3c: market related risks to carbon farming project

Source	Impact (Consequence X likelihood)	Mitigation strategy
Ongoing failure of government to implement carbon pricing policy	Serious for project, possible	Maintain high visibility and access to buyers in both compliance and voluntary carbon markets to maximise credit sale price; seek to develop long-term offtake agreements with large emitters with balanced spread of fixed and floating sale rates to enjoy market upsides
Emission Reduction Fund Carbon Abatement Contract Fixed delivery obligations on volume and price for Project Proponent	Serious for Project Proponent, possible (liquidated damages require Project Proponent to pay out contract under delivery at market rates of the day)	Consider alternative options for sales of ACCUs that don't carry such punitive impacts as fixed price and volume delivery. Seek optional delivery contracts or market alternatives that allow for market linked pricing and upside
Carbon market prices don't increase as predicted	Serious for project, possible	Ensure that project outcomes are important to landholder and their property plans and aspirations; identify carbon price at which it is no longer viable and organise for orderly unwinding/revocation; identify alternative market sales opportunities. Holding appropriate volume of insurance ACCUs.

Appendix 4: Case study assumptions

In developing the financial model and case studies, the following assumptions were made and applied to all three case studies and scenarios:

- The area selected for the HIR carbon project requires a reduction in stocking rate to 20% of the current carrying capacity for the first 5 years
- Between years 6 and 15, carrying capacity is increased from 20% to 60% of the current capacity
- From year 16 onwards, the carrying capacity is maintained at 60% of the current capacity
- Carrying capacity on the remainder of the station remain as per BAU
  - Note that there is no specified management intervention required by the HIR methodology, however a management plan must be developed and submitted to the Clean Energy Regulator demonstrating how the required vegetation parameters will be achieved in the life of the project. The management interventions required will be unique for each HIR project area. In these case studies, we have proposed the use of the "managing the timing and extent of grazing" mechanism rather than "destocking and keeping destocked" mechanism in the method.
  - The management interventions used in these case studies reflect the professional experience in managing rangeland conditions across similar landscapes and are not prescriptive for individual circumstances.
- Where the reduction in carrying capacity resulted in stocking rate exceeding carrying capacity on the project area, the excess livestock were sold to match the carrying capacity for that season.
- The same seasonal sequence has been assumed for the three livestock enterprises and the three carbon project areas for each enterprise
- Livestock productivity has been kept constant across each seasonal definition for the 25-year project life and indexation has not been applied to costs and prices – all prices and values are in today's dollars (2020)
- Any value associated with having a registered HIR carbon project on the case study station has not been reflected in land value; the land value remains constant for the life of the project. It may be that as management interventions improve the condition and carrying capacity of the station, land values may improve over time - another conservative assumption.
- Total livestock value fluctuates with seasonal influence on numbers, weights, and prices.
- Depreciation has been applied to plant, vehicle, and equipment values, with an annual replacement allowance in capital expenditure to keep total value constant.
- The model does not include any capital development costs required to implement a HIR project, e.g. fencing and waters, due to the unique difference between properties and must be taken into account when the financial viability of a HIR project is being assessed by a landholder.
- A gross carbon yield per ha per year across the 25-year project life was determined using the FullCAM model as per the approved HIR methodology; these yields being shown in Table 2 and Appendix 1.
- No allowance has been made for the loss of sequestered carbon due to fire during the project period.
- The current market price (as of 19th November 2020[29]) of $16.50 per ACCU was applied to the carbon sequestered in the project area, with the landholder credited 70% of this gross income (30% being paid to the project proponent to manage the project, work with the pastoralist to develop a management plan for the project area, undertake all project reporting and auditing requirements and assume permanence risks).

[29] www.accus.com.au

Appendix 5: Additional information and links to useful sites

Links to Carbon Farming Market websites

- Information about the various land sector methods and to help you identify which one may be more suited to you, go to the Federal Government, Clean Energy Regulator website and choose either Agricultural Methods, Savanna Burning or Vegetation Methods.
  http://www.cleanenergyregulator.gov.au/ERF/Choosing-a-project-type/Opportunities-for-the-land-sector
- Case studies for each of the soil, vegetation and agricultural methods go to the resources section of the Federal Government, Clean Energy Regulator website. Under Emissions Reduction Fund Methods you can select the method you are interested in and it will take you to a page that has the necessary up to date information about the method and any changes that have been made.
  https://www.environment.gov.au/climate-change/government/emissions-reduction-fund/publications
- Background on the markets for businesses going Carbon Neutral and Offsetting their businesses the Carbon Market institute explains the entry process. The website focuses on businesses who may be looking to buy ACCUs. Understanding the buying market can give further insights into the selling market.
  http://marketplace.carbonmarketinstitute.org/
- A 2019 report looking at the way Carbon Projects are grouped as well as the supply and demand for Carbon Credits in Australia found at:
  https://research.csiro.au/digiscape/evolving-australian-carbon-markets/
- Resources, fact sheets and current information on soil carbon, savanna burning, herd improvement, business analysis and grazing land management from Future Beef.
  https://futurebeef.com.au/knowledge-centre/climate-clever-beef-publications/#ccbcasestudies

Web links for applying to become involved in the Carbon Market

- Work out what type of project might be applicable on your property with information from the Clean Energy Regulator:
  http://www.cleanenergyregulator.gov.au/ERF/Choosing-a-project-type
- Information on how to participate in the Emissions Reduction Fund from the Clean Energy Regulator:
  http://www.cleanenergyregulator.gov.au/ERF/Want-to-participate-in-the-Emissions-Reduction-Fund

Carbon Industry Code of Practice

- Carbon Project Developers and other Carbon Industry providers like agents, aggregators and advisors, can voluntarily sign up to be part of the Australian Carbon Industry Code Of Practice. Administered by the Carbon Market Institute (CMI), the Code aims to address issues that impact on the reputation of the carbon industry and promote international leadership on carbon project development.
  http://marketplace.carbonmarketinstitute.org/code/

Further Reading

- Information on projects registered under the Emissions Reduction Fund and about carbon abatement contracts awarded.
  http://www.cleanenergyregulator.gov.au/ERF/project-and-contracts-registers
- Information on the tax treatment of Australian Carbon Credit Units from the Clean Energy Regulator
  http://www.cleanenergyregulator.gov.au/ERF/Want-to-participate-in-the-Emissions-Reduction-Fund/Step-4-Delivery-and-payment/Tax-treatment-of-ACCUs
- Information on the tax treatments and implications of carbon sink activity from the Australian Tax Office
  https://www.ato.gov.au/business/income-and-deductions-for-business/in-detail/carbon-sink-forests/
- A link to the Carbon Credits (Carbon Farming Initiative) Act 2011:
  https://www.legislation.gov.au/Series/C2011A00101