CARBON FARMING AND BIODIVERSITY CONSERVATION

Case studies of three Queensland beef properties

ACKNOWLEDGEMENTS

This report summarises the results of a WWF-led project entitled "Protecting Threatened Species and Restoring Grazing Land" (LRF035), which was supported by the Queensland Government as part of the Pilot Projects Program of the Land Restoration Fund. The report was prepared by Leanne Sommer, while working at WWF-Australia and Resource Consulting Services (RCS) Australia, supported by Joshua Bishop of WWF-Australia.

The core project team was led by Leanne Sommer and relied on invaluable contributions from Tanya Pritchard (while at Queensland Trust for Nature (QTFN)), George Stacey (RCS), Adam Curcio (RCS), and Eoghan O'Connor (while at GreenFleet), as well as three producer families, namely:

- The McArthurs of 'Mystery Park', St Lawrence
- The Gibsons of 'Coonabar', Rolleston
- The Lawries of 'Moora Plains', Gogango

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WWF-Australia acknowledges the Traditional Owners of the lands on which we work and their continuing connection to their lands, waters and culture. We pay our respects to Elders, past and present, and emerging leaders. WWF is one of the world's largest and most experienced independent conservation organisations, with over five million supporters and a global network active in nearly 100 countries. WWF's mission is to stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature, by conserving the world's biological diversity, ensuring that the use of renewable natural resources is sustainable, and promoting the reduction of pollution and wasteful consumption.

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No part of this report should be construed as endorsement by individuals or organisations involved in its production of specific tools, methods or standards used to measure and verify carbon sequestration, emission reductions or biodiversity outcomes from land use change.

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GLOSSARY

Australian Carbon Credit Unit (ACCU)	One ACCU represents one tonne of carbon dioxide equivalent (tCO2-e) credited to a registered carbon farming project. Abbreviated as 'carbon credit'.
Baseline	A fixed point of reference that is used for comparative purposes.
Carbon credit	A standard unit of measurement for the avoidance of greenhouse gas (GHG) emissions or the removal of CO_2 from the atmosphere, usually expressed in terms of tonnes of CO_2 equivalent (tCO_2-e).
Carbon Estimation Area (CEA)	The area where the project management activities will be carried out, where carbon will be stored, and for which the project may be issued ACCUs. The boundary of each CEA must be defined using the Carbon Farming Initiative Mapping Guidelines.
Category X areas	Areas not generally regulated under Queensland vegetation management laws. Category X areas are colour-coded white on the regulated vegetation management map under the *Vegetation Management Act 1999* (Qld).
Conservation covenant	A voluntary agreement between a landholder and an authorised body (such as a Covenant Scheme Provider) that aims to protect and enhance the natural, cultural and/or scientific values of a parcel of land. The owner continues to own, use and live on the land while the natural values of an area are conserved by the landholder in partnership with the provider. Covenant Scheme Providers can be not-for-profit organisations, government agencies or local councils that enter into conservation covenants with landholders to protect land with particular conservation values. In this project, the term conservation covenant refers to Nature Refuges as defined under the *Nature Conservation Act 1992*, whereby an agreement is documented between a landholder and the State of Queensland for permanent protection of certain conservation values identified on a property.
Crediting period	The amount of time over which a project can generate ACCUs. Emissions avoidance projects have a crediting period of seven years. Sequestration projects have a crediting period of 25 years, regardless of the permanence period (except in the case of avoided deforestation projects).
Discount	In carbon farming methodologies involving the growth of vegetation ('tree carbon'), a 20% discount is applied to the carbon yield if the project has a permanence period of 25 years. No discount applies if the permanence period is 100 years.
Exclusion zones	Areas where carbon farming project activities will not be conducted, such as a road, building or reservoir.
Gross margin (GM)	A way of measuring the profit an enterprise derives from its activities. It is calculated by subtracting the total production cost of goods or services sold from total sales revenue, and then dividing that figure by total revenue. That yields a percentage figure representing the portion of revenue that the enterprise retains as profit (taxes may be additional). For example, if a company has a 20% gross margin and sells $100 million worth of products over the course of a year, then its profit would be $20 million. Some or all of that $20 million may still need to be spent on paying shareholders or other business expenses. Gross margin levels can vary widely, depending on the industry and other factors.
Gross margin/stock day (GM/SD)	Over the course of one full year, one Livestock Unit (LSU) will account for 365 stock days, hence the formula below is used to calculate the GM per stock day: $\frac{\text{GM/LSU}}{\text{365 Day}}$ = GM/stock day Example During the financial year 2019–20, Property A has a total Production Gross Margin (Gross Revenue – Direct Costs) for cattle of **$950,000** and turned over a total of **2,400 LSU**. Therefore, the GM/LSU will be 950,000 ÷ 2,400 = **$395.83**. Using the formula given above, we can derive the GM/stock day for Property A as follows: $\frac{\$395.83}{365}$ = $1.08 per stock day Major factors affecting GM/SD include market conditions, land type, grazing system and animal health (e.g. reproduction rates, stock psychology).
Livestock Unit or Large Stock Unit (LSU)	Within a grazing enterprise, there may be large variation in livestock ages and sizes and therefore a large variation in the nutritional requirements of each class of animal and how much they consume in a given day. For this reason, a Standard Animal Unit (SAU) scale is used to give each class of animal a standardised rating. This is expressed in Large Stock Units (LSUs), where 1 LSU = 450 kg steer with no live weight gain (at maintenance).
Method/methodology	An activity approved by the Regulator (or by a voluntary carbon standard) for generating ACCUs or carbon credits.
Permanence period	The period of time that the Regulator is confident that carbon has been removed from the atmosphere. There are two options for permanence periods: 25 or 100 years.
Stock day (SD)	The amount of feed 1 LSU consumes in one day. This can be calculated on a per hectare basis to give stock days per hectare (SDH). This unit of measurement can be used to assess both stocking rates and carrying capacity.
Stock days/ hectare/100mm rainfall (SDH/100mm)	Many grazing businesses set their carrying capacity benchmark based on an 'average' rainfall year, but (in reality) average rainfall years are very rare in most regions across Australia, with the majority experiencing highly variable wet and dry seasons. This high variance can lead grazing operations to subjectively guess their carrying capacity from year to year. Miscalculating carrying capacity can result in severe, drought-like conditions and subsequent drought feeding which, in turn, may cause economic stress, as well as ecological damage to overgrazed lands. Resource Consulting Services (RCS) Australia has developed a system for assessing carrying capacity based on SDH per 100mm of rainfall to account for this variability. Using this system allows graziers to make proactive changes to their stocking rates as shifting seasonal conditions alter actual carrying capacity, allowing ground cover and soil health to be maintained. SDH/100mm is essentially a measure of the ability of a certain land type and the water cycle to convert rainfall into useable fodder. Example Suppose Property A receives 625 mm rainfall over one year and is considered to have a long-term carrying capacity of 3 ha/LSU, i.e. it would require 3 hectares to sustain 1 LSU for 1 year. This can be converted into SDH/100mm using the following steps: Long-term carrying capacity = 3 ha/LSU 365 days ÷ 3 ha/LSU =121.6 stock days/ha Annual rainfall = 625 mm/year 121.6 SDH ÷ 625 mm = 0.194 SDH/mm 0.194 SDH/mm x 100 = **19.4 SDH/100mm**

A red poppy (Pimelea haematostachya) on Moora Plains. © Queensland Trust for Nature

ABOUT OUR PROJECT[1]

- *The Land Restoration Fund is a $500 million investment by the Queensland Government to expand carbon farming in the state through land-sector projects that deliver additional environmental, social and economic co-benefits.*
- *The Land Restoration Fund's Pilot Projects Program offered $5 million in funding for projects to expand the scope of Queensland's carbon farming industry through market development and on-ground projects to deliver carbon abatement.*
- *This Report was delivered as part of the Pilot Projects Program of the Land Restoration Fund, supported by the Queensland Government, WWF-Australia, Resource Consulting Services Australia, Greenfleet and three beef producer families in Queensland.*
- *The Pilot Projects Program aims to catalyse land manager participation, demonstrate how carbon farming activities can generate co-benefits and generate and collate data that measures and values co-benefits to support growth of new environmental markets over time.*
- This project ("Protecting Threatened Species and Restoring Grazing Land") was designed to explore new opportunities for investment in grazing lands that delivers multiple benefits: enhancing habitat for threatened species, carbon sequestration, soil conservation, improved water quality, and diversified income for participating beef producers.
- We examined the opportunities and challenges associated with carbon farming with co-benefits, using the Human-Induced Regeneration of a Permanent, Even-Aged Forest (Human Induced Regeneration (HIR)) methodology, as defined by the Australian Government's Clean Energy Regulator.
- HIR is an approved, land-based carbon farming methodology that delivers carbon yields through the regeneration of native vegetation over a 25 or 100-year time period. Two carbon farming scenarios are available within the HIR methodology: environmental, whereby cattle are excluded from the carbon estimation areas; and regenerative, whereby cattle continue to graze in the carbon estimation areas. By year 100, the two scenarios should reach equivalent carbon yields.
- The project deliverables included a report on the feasibility of carbon farming on three Queensland beef properties, the biodiversity co-benefits of carbon farming for each property, and business cases to support investment in conservation and carbon outcomes on these properties.
- This report summarises those investigations and presents an overview of the key findings. A comprehensive pilot study report was also prepared for the Queensland Department of Environment and Science.

[1] Note: Text in Italics is approved wording from the Land Restoration Fund Communications Protocol.

WHAT IS CARBON FARMING?

Carbon farming is a method or process of earning carbon credits that is approved through legislation administered by the Australian Government's Clean Energy Regulator (CER). There are two basic types of carbon farming:

- avoidance, whereby emissions of greenhouse gases (GHG) are avoided by taking some action to reduce emissions, such as from land clearing; and
- sequestration, whereby GHG emissions are counterbalanced by activities that result in the storage of carbon, usually in vegetation or soil.

Carbon farming projects have a defined permanence period, which is the period for which a project must be maintained. For carbon farming projects involving vegetation growth, the permanence period is 100 years, with an option for a 25-year permanence period that results in a 20% discount in yield.

A carbon farming project is registered with the CER, and is recorded as an encumbrance on the title of the land where it occurs. The process and documentation required to register a carbon farming project can be complex.

Carbon yields from undertaking a carbon farming project must be measured or estimated at least once every five years, and the yield is expressed in Australian Carbon Credit Units (ACCUs). ACCUs can be sold at auction or directly to a buyer.

Baseline carbon measurements or yield estimates are required before a carbon farming project commences. In Australia, carbon yields can be estimated using a numerical model known as a Full Carbon Accounting Model (FULLCAM) for some carbon farming methods, but not all methods can use such models. For example, some soil carbon farming projects currently require actual on-ground measurement of soil carbon, which can increase the cost of undertaking the project.

Not all carbon sequestration activities have an approved carbon farming method. New methodologies are being developed, most recently with the publication of a method for achieving carbon sequestration through the restoration of aquatic and marine environments (blue carbon).

Each approved carbon farming methodology sets out the activities that need to be undertaken to ensure the anticipated carbon yields are realised.

Oberthuri silk moth (Syntherata escarlata) caterpillar, Mystery Park. © Queensland Trust for Nature

WHAT DOES THE HUMAN INDUCED REGENERATION OF A PERMANENT EVEN AGED FOREST (HIR) METHOD INVOLVE FOR GRAZING LANDS?

Extracts from the Clean Energy Regulator website:

The Human Induced Regeneration of a Permanent Even Aged Forest (HIR) method is designed to achieve increased forest cover and carbon sequestration by carrying out eligible activities that encourage the regeneration of Australian native tree species, i.e. species that are indigenous to a project's local area.

A parcel of land may be eligible for HIR carbon farming if:

1. it did not have forest cover at any time during its baseline period, but it has the potential to regenerate forest;
2. the parcel covers at least 0.2ha and the regenerated forest will have trees that are two metres or more in height and provide crown cover of at least 20 per cent of the land;
3. during its baseline period, it was used or managed in such a way that one or more of the following mechanisms contributed to suppressing the development of forest cover:
    d. livestock;
    e. feral animals;
    f. plants not native to the area; and/or
    g. mechanical or chemical destruction, or suppression, of vegetation regrowth.

Human-induced regeneration activities include:

- 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; and
- permanently ceasing mechanical or chemical destruction, or suppression, of native regrowth.

Eligible activities must be conducted within a project area but may not necessarily occupy the entire space. It is important to understand how project areas are defined and what this means for managing the land (see Figure 1).

The crediting period for a HIR carbon farming project is 25 years. A crediting period is the time over which a carbon project can generate credits. Emissions avoidance projects have a crediting period of seven years whilst carbon sequestration projects have a crediting period of 25 years.

Although the HIR method was used as the basis of analysis in this report, we are aware of public debates about the credibility of this method and of carbon markets more generally. This report should not be interpreted as endorsing any particular standard or method for increasing carbon storage on farmland, nor as an expression of unqualified support for carbon offsets, but rather as an illustration of the technical and financial issues that arise when applying a commonly used carbon farming method (HIR) in a specific context.

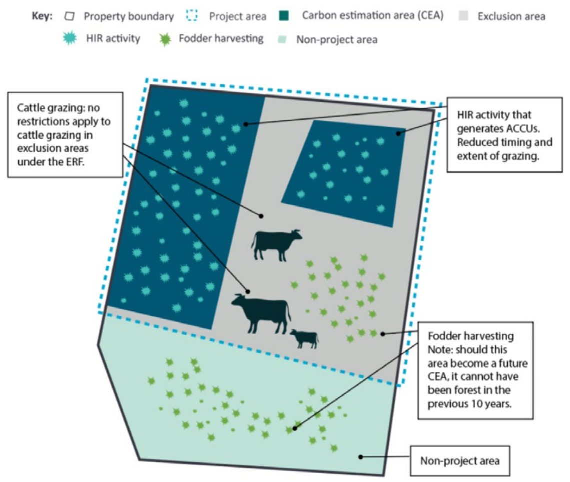


Figure 1: Illustration of how a property may be managed for both a HIR project and grazing livestock.

Project partners and Department of Environment and Science staff at Mystery Park. © WWF-Australia

WHO WE ARE

- The project was led by WWF-Australia and involved collaboration with Resource Consulting Services Australia, Queensland Trust for Nature, Greenfleet, the Gibson family of Coonabar, the Lawrie family of Moora Plans and the McArthur family of Mystery Park.
- **WWF-Australia** is one of the most trusted conservation organisations working in Australia and part of the global WWF network, which seeks to protect endangered species and habitats, meet the challenge of climate change, and build a world where people live in harmony with nature.
- **Resource Consulting Services Australia** (RCS) is one of Australia's leading private providers of holistically-integrated education, training and advisory services to the agricultural sector, both nationally and internationally.
- **Queensland Trust for Nature** (QTFN) is a conservation-focused, independent, not-for-profit organisation that works with landholders, educators, businesses and government to develop and demonstrate scalable environmental projects on private land.
- **Greenfleet** is a leading not-for-profit organisation committed to protecting our climate by restoring forests. Greenfleet engages in forest revegetation in Australia and New Zealand, and provides carbon offsets to its supporters.
- The **Gibson family** own and operate a beef cattle business at Coonabar, near Rolleston in central Queensland. Murray and Wendy, and Cameron, Kristy and their three children use ecosystem health to build business profitability. The family is passionate about finding new ways to increase business profitability and improve their ecosystems.
- The **Lawrie family** own and operate a beef cattle business at Moora Plains, west of Rockhampton in central Queensland. Andrew and Meagan are 'grass farmers' who turn pasture into profit via animal production. The key focus of their business is using grazing management to improve the ecosystem. Moora Plains is a productive, healthy and innovative beef property.
- The **McArthur family** own and operate Mystery Park, a beef cattle property on the central Queensland coast. The underlying philosophy that Rob, Ainsley and their six children apply is to capture sunlight to grow grass that produces healthy, nutritious beef while simultaneously regenerating the ecosystem. Their key driver for making changes to their business is to create a healthy environment for future generations.
- Project partners were supported by **Carbon Link** through the provision of soil carbon feasibility studies on two of the three properties. Soil carbon is of great interest to beef producers as it has the potential to enhance farm profitability, farm resilience and environmental outcomes.
- **Bain and Company** supported the project on a pro bono basis, reviewing economic data and assumptions, and creating the financial model for carbon farming with biodiversity co-benefits on the three properties.

WHAT WE DID

IDENTIFYING PILOT BEEF PRODUCERS

- Mapping of project opportunities was undertaken for HIR carbon farming where Category X vegetation under the *Vegetation Management Act 1999* (Qld) corresponded with high biodiversity potential in Great Barrier Reef catchments.
- Beef producers with properties identified through the mapping were invited to participate in the project, and three families joined as project partners in August 2019 (Figure 2).

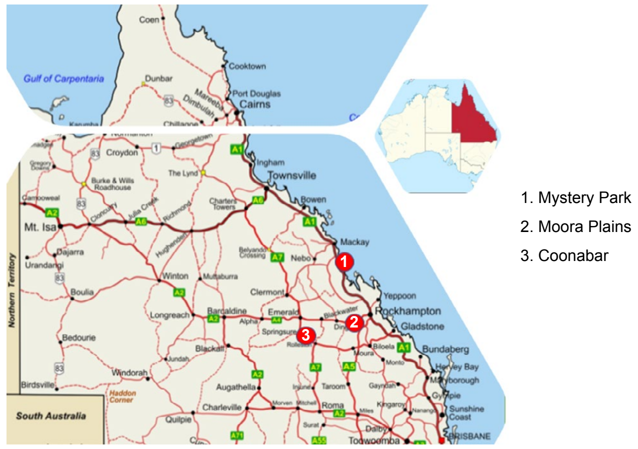
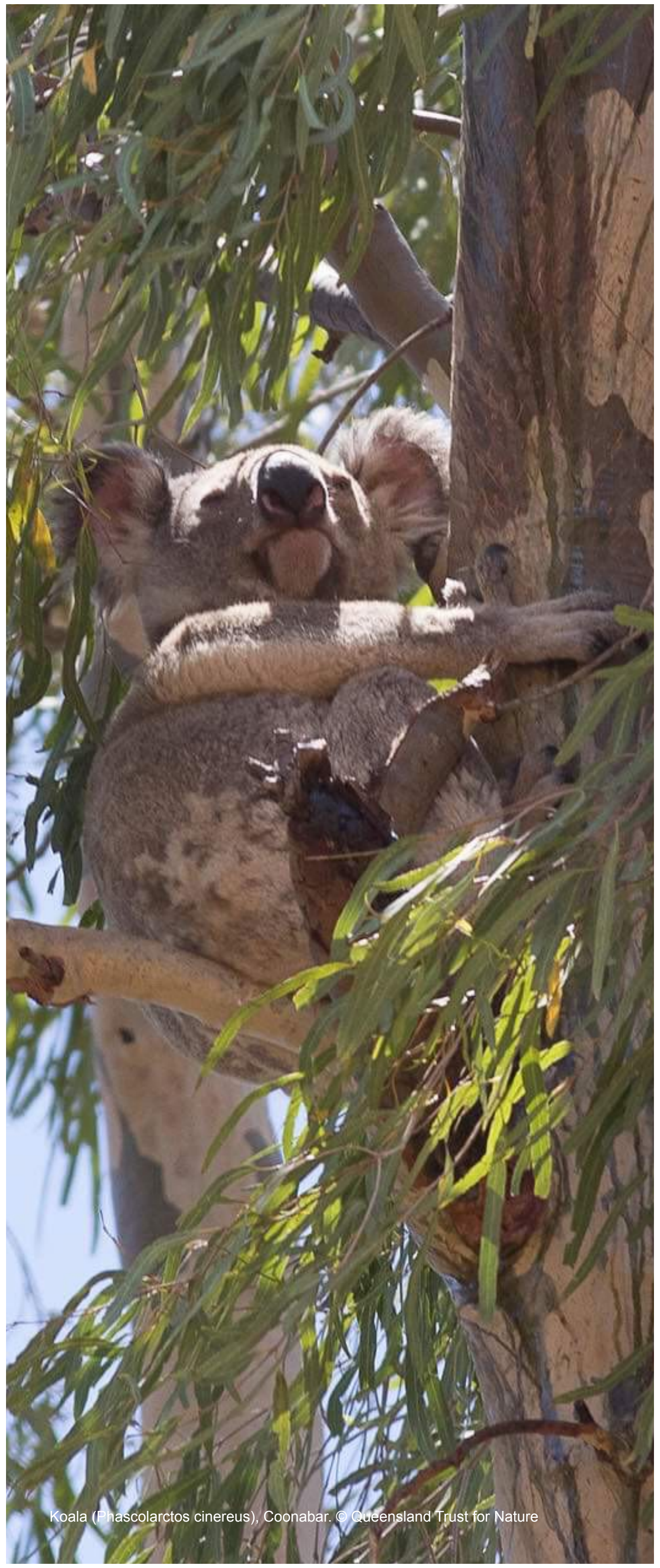


Figure 2. Location of project partners' beef properties.

ENGAGEMENT AND COLLABORATION

- A tour of the three grazing properties was undertaken from 23–26 October 2019 to allow project partners and Department of Environment and Science staff to share thoughts and ideas on grazing land management, and the opportunities and challenges of tree carbon farming utilising native regrowth. The tour involved a core group of 11 people, with others joining when available.
- Fact sheets were developed to summarise the available information on:
  - tax implications of carbon farming and conservation management;
  - conservation agreements and market-based conservation incentives;
  - opportunities for carbon-neutral or low-carbon claims for beef production; and
  - biodiversity surveys and assessments.



Koala (Phascolarctos cinereus), Coonabar. © Queensland Trust for Nature

Dingo (Canis familiaris), Mystery Park. © Queensland Trust for Nature

- Monthly partner meetings took place from May 2019 to August 2020 to report on progress and discuss specific themes for advancing carbon farming and biodiversity co-benefit projects on each property. Additional meetings were scheduled to discuss topics in depth or invite others to join discussions.
- Project partners provided their final input to the project findings and confirmed key conclusions at a producer workshop held in Rockhampton on 12 August 2020.

BIODIVERSITY SURVEYS AND ASSESSMENTS

- Flora and fauna surveys and bio-condition assessments were conducted at Coonabar, Moora Plains and Mystery Park between November 2019 and May 2020 to establish the biodiversity values that were most suited to deliver co-benefits with carbon farming using the HIR methodology. Bio-condition assessments provide a measure of the capacity of an ecosystem to maintain biodiversity values at a property scale. They are site-based, quantitative and repeatable assessment procedures that provide a numerical score that reflects the condition of habitat for supporting biodiversity.
- The LRF Native Vegetation Method was used, under the Accounting for Nature framework, to record, present and interpret the ecological data. This framework builds biophysical accounts using a common unit of measure (environmental condition or 'Econd'). The process involves:
  1. identification of environmental assets aligned with the framework;
  2. selection of environmental indicators for each asset;
  3. determination of reference benchmarks used as a baseline for comparison;
  4. calculation of Indicator Condition Scores (ICS) using national standards; and
  5. calculation of Econds.
- Baseline biodiversity values on all three properties were very high, with each supporting significant species richness and good habitat conditions. Predicted condition scores were developed for key assets at the end of a 25-year planning period.
- Property management plans were drafted for each property to identify management activities that would assist or promote the enhancement of key biodiversity values over the 25-year permanence period.
- Conservation covenants, in the form of Nature Refuges under the *Nature Conservation Act 1992* (Qld), were considered but not developed for each of the beef properties. This is discussed further below in the section entitled What We Found.

Seven months after the commencement of this pilot, the LRF scheme documentation was released for the LRF Investment Round 1, outlining options for the assurance of certain co-benefits, including proponent assurance. The relevant co-benefits for our pilot, using the HIR carbon method and designing biodiversity co-benefits that can be proponent assured, were:

- **threatened ecosystems co-benefit** – if the project is regenerating native vegetation in a pre-clearing threatened ecosystem;
- **threatened species co-benefit** – if the project is regenerating native vegetation within an area of potential habitat for a threatened species; and
- **native vegetation.**

Additional co-benefits are also accepted by the LRF through proponent assurance for the HIR carbon farming method. These included:

- **Great Barrier Reef co-benefit** – if the project is regenerating pre-clearing wetlands in the Great Barrier Reef, or is regenerating native vegetation within a catchment targeted for sediment reduction;
- **wetlands co-benefit** – if the project is regenerating native vegetation in a pre-clearing wetland; and
- **coastal ecosystems co-benefit** – if the project is regenerating native vegetation in a pre-clearing coastal ecosystem.

"Third-party assurance is more likely to be used or required where the dollar value of the co-benefit premium agreed between the project proponent and the Land Restoration Fund is higher, or where there is a higher degree of uncertainty associated with the delivery of the co-benefits seeking to be claimed." (Land Restoration Fund Co-benefits, Standard Version 1.2, January 2020).

CARBON YIELD ESTIMATES

- Estimates of carbon yields were calculated for the proposed carbon estimation areas on each property using the draft FULLCAM methodology for HIR carbon farming released for public comment in August 2020. These estimates were calculated for individual paddocks at each property, to assist decision-making about which areas were best suited to carbon farming. Carbon yields associated with two scenarios were calculated using the draft HIR methodology:
  1. *environmental* HIR, where cattle are excluded from CEAs; and
  2. *regenerative* HIR, where cattle grazing is managed to optimise vegetation regrowth in the CEAs.
- Carbon Link conducted stage 1 Soil Carbon Discovery studies on Mystery Park and Coonabar that outlined the feasibility of soil carbon farming as an alternative carbon farming methodology of interest to the producer families. Moora Plains has an existing registered soil carbon farming project.


Apostle bird (Struthidea cinerea), Moora Plains. © Queensland Trust for Nature

FINANCIAL BENCHMARKING

- The Gibson, Lawrie and McArthur families underwent financial analysis and benchmarking via RCS's ProfitProbe™ tool. Results of the ProfitProbe™ were then used to estimate the opportunity costs of a carbon farming and co-benefit project using the HIR methodology.


Bower of the spotted bowerbird (Chlamydera maculata), Coonabar. © Queensland Trust for Nature

- Carrying capacity in 2020 on each of the properties was used as the basis for estimating the decrease in carrying capacity expected as vegetation cover increases with carbon farming. Carrying capacity is based on the Stock Days/Hectare/100mm rainfall method (RCS Australia). This is essentially a measure of the country's ability to convert rainfall into productive pasture.
- Gross margin per stock day is based on individual ProfitProbe™ results and land type-specific benchmarking group averages. Lack of rainfall and lower levels of production in 2020 were taken into account. Rainfall data from the previous 10 years was used to forecast the coming 25-year period. The total project area was based on the proposed carbon estimation areas developed for each property.
- The potential depreciation in land value resulting from HIR carbon farming was calculated based on a combination of the expected loss of carrying capacity that would be associated with the carbon project, the current negative attitude adopted by valuers and banks towards carbon projects, and recent land sales where the properties are located.
- The impacts of a prolonged dry period were evident across all three properties. Nevertheless, Moora Plains, Coonabar and Mystery Park displayed good economic performance despite the continued dryness.
- Reducing cattle numbers instead of maintenance feeding through dry times is an essential business decision employed by these businesses. While this may involve small sacrifices in production over the duration of the dry period, it has maintained a sound level of ground cover and ecological health, leaving the country 'rain ready' and limiting the financial cost of buying in feed.

Stock Days/Hectare/100mm Rainfall (Sdh/100mm)

Many grazing businesses set their carrying capacity benchmark on an 'average' rainfall year, where (in reality) average rainfall years are very rare in most regions across Australia, with the majority experiencing highly variable wet and dry seasons. This can cause many grazing operations to subjectively guess their carrying capacity levels from year to year. Misjudging carrying capacity can cause a shortage of pasture and subsequent drought feeding, which, in turn, can cause intense economic strain and ecological damage from overgrazing.

RCS has developed a system of assessing carrying capacity based on SDH per 100mm of rainfall to account for this variability. This allows graziers to make early changes to their stocking rates as seasonal conditions change the actual carrying capacity, allowing ground cover and soil health to be maintained. This is essentially a measure of the ability of that land to convert rainfall into useable fodder.

PUTTING IT ALL TOGETHER

- One key project outcome was a financial analysis of carbon farming with biodiversity co-benefits. Profit and loss sheets were developed for a HIR carbon farming project with biodiversity co-benefits for each property, including assumptions regarding:
  - a partnership with a carbon service provider;
  - the costs of measurement and management activities to support both carbon farming and biodiversity enhancements (overheads);
  - the opportunity costs of HIR carbon farming through predicted loss of carrying capacity; and
  - potential income from the sale of carbon credits, with a co-payment for biodiversity co-benefits.
- Bain and Company developed an interactive financial model that allowed the producers to assess the financial performance of a HIR carbon farming project with biodiversity co-benefits under a range of assumptions. The model allowed producers to vary, at will:
  - the percentage of their property devoted to carbon farming, in either regenerative or environmental scenarios, or both;
  - the price of carbon and biodiversity co-payment (per tCO_2-e);
  - the rate of tax on carbon and biodiversity income;
  - the carbon service provider's revenue share;
  - the discount rate (for NPV analysis); and
  - the carbon permanence period (25 or 100 years).
- The model calculates both cumulative and year-by-year financial positions over the 25-year crediting period of a HIR carbon farming project. The impact of high start-up and overhead costs and a 15-year term for biodiversity co-payments is graphically illustrated in Figure 3 (for Coonabar). The business case in this scenario is weak, given the starting assumptions set out in Table 1.
- The model also provides a financial analysis for each property, showing the project area, income from carbon farming and biodiversity co-benefits, all costs including overheads, changes in land value and loss of carrying capacity (opportunity cost), annual cash flow and discounted NPV, as well as per hectare values.
- A sensitivity analysis on NPV per hectare is shown for each property in Figure 4. Cells with green shading show that the combined price of carbon and biodiversity would need to exceed \$230 per tCO_2-e, and carbon farming would need to occupy at least 10% of each property, in order to match the value of the land (as reported by RCS).
- Summary data for Moora Plains, Coonabar and Mystery Park are provided in an Annex to this report (Tables A1, A2 and A3). The business case for carbon farming using HIR with biodiversity co-benefits appears to be weak, based on a carbon price of \$13 per tCO_2-e and other cost and revenue assumptions used in this model run.

	Coonabar	Mystery Park	Moora Plains	Notes and sources
Income Assumptions				
% of property for regeneration	10%	10%	10%	Cattle graze under growing trees
% of property for environmental	0%	0%	0%	Remove cattle from day 1 (not modelled)
Reduction for 25 year permanence period	20%	20%	20%	ERF rule
Bioiversity price ($/tCO2-e): years 1 to 15 only	50	50	50	Scenario assumption
Carbon price ($/tCO2-e): years 1 to 25	13	13	13	Estimated real market price
Opportunity Cost Assumptions				
Loss of Carrying Capacity				
Project Area (Ha)	4,773	4,648	3,442	
Gross Margin/Stock Day (A$)	0.85	0.55	0.75	RCS provided
Stock-Days/Ha/100m rainfall	25	17	25	RCS provided (SD = feed/LSU/day)
Annual SDH/100m depreciation (due to tree growth)	0.83	0.21	0.285	RCS provided
Depreciated Land Value				
Current A$/Ha	2,507	1,600	2,663	RCS provided
Depreciation in Land Value over 25 years	40%	25%	30%	RCS provided
Overhead Cost Assumptions				
Carbon revenue share (% taken by service provider) - carbon farming	35%	35%	35%	Varies from 25-35%
Carbon revenue share (% taken by service provider) - biodiversity	0%	0%	0%	Scenario assumption
Other biodiversity costs (mgmt. plan, monitoring, etc) - A$ cumulative	895,591	895,591	895,591	Scenario assumption over 15 years
Other Assumptions				
Discount rate (for NPV analysis)	10%	10%	10%	Scenario assumption over 25 years
Tax rate	30%	30%	30%	Scenario assumption

Table 1. Starting assumptions for financial analysis of carbon farming with biodiversity co-benefits.

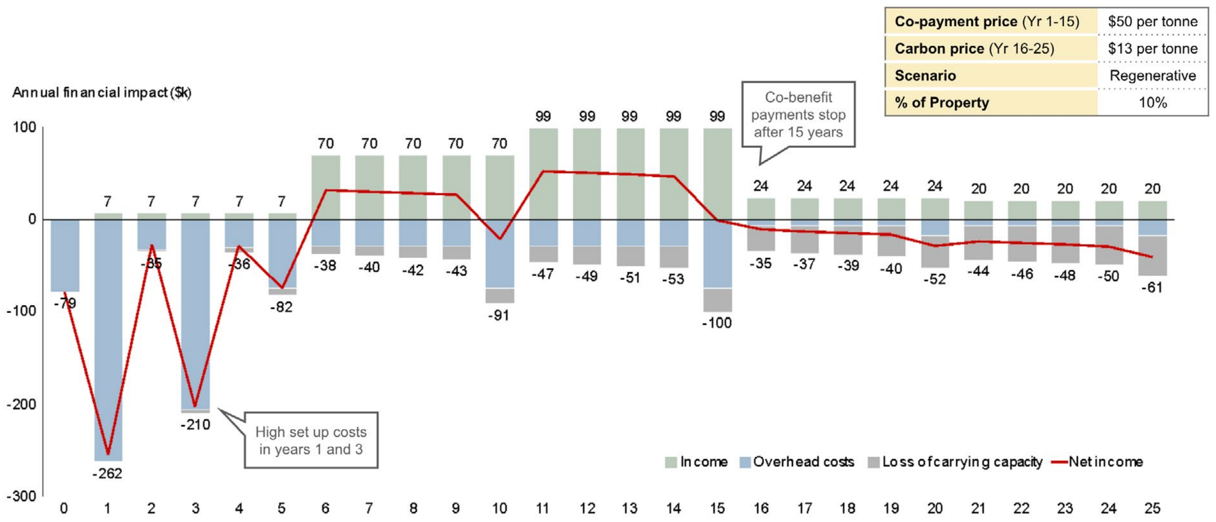
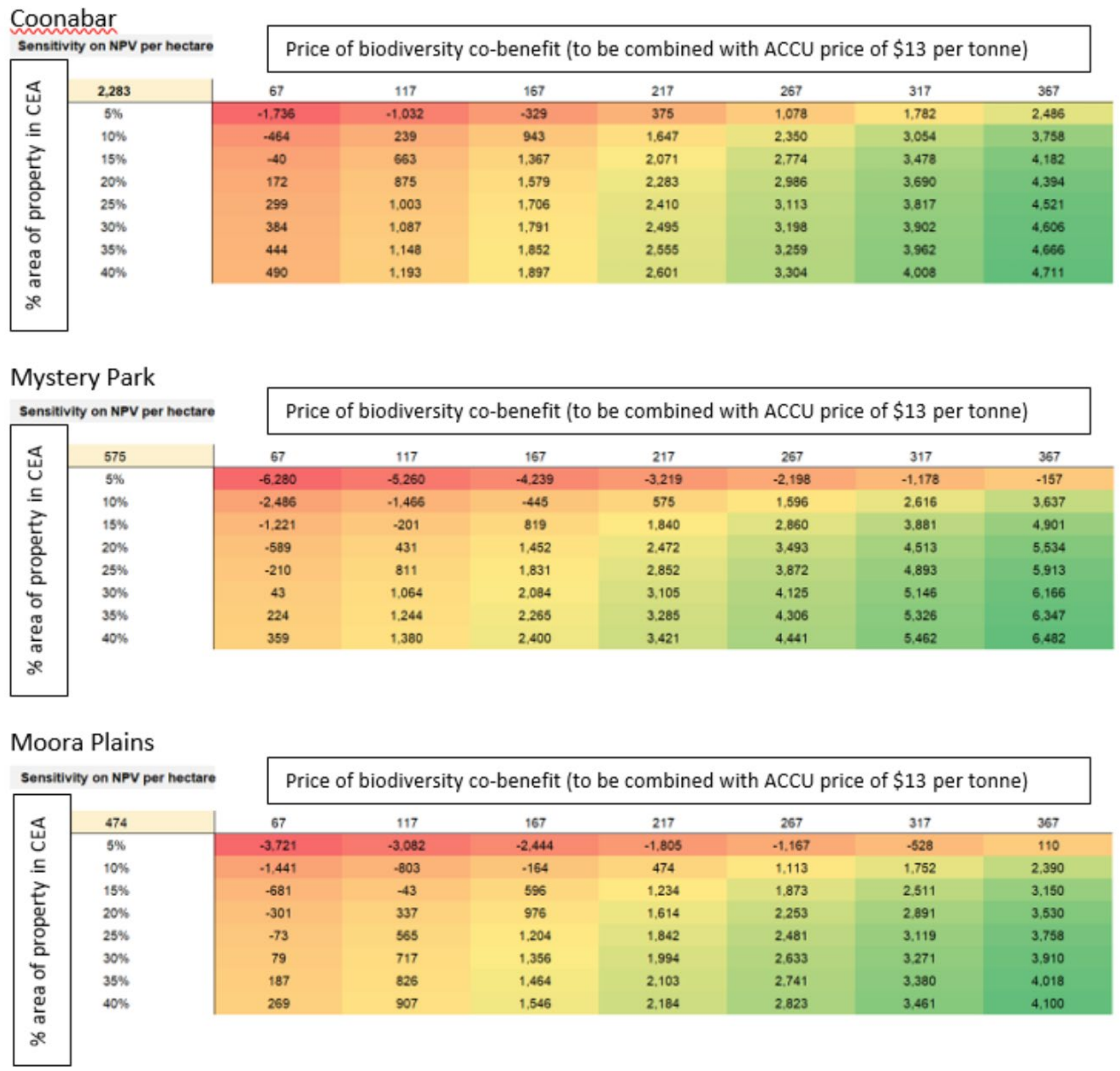


Figure 3. Projected financial impact for Coonabar, assuming 10% of property under HIR carbon farming.



Coonabar

Sensitivity on NPV per hectare

Price of biodiversity co-benefit (to be combined with ACCU price of \$13 per tonne)

% area of property in CEA

2,283	67	117	167	217	267	317	367
5%	-1,736	-1,032	-329	375	1,078	1,782	2,486
10%	-464	239	943	1,647	2,350	3,054	3,758
15%	-40	663	1,367	2,071	2,774	3,478	4,182
20%	172	875	1,579	2,283	2,986	3,690	4,394
25%	299	1,003	1,706	2,410	3,113	3,817	4,521
30%	384	1,087	1,791	2,495	3,198	3,902	4,606
35%	444	1,148	1,852	2,555	3,259	3,962	4,666
40%	490	1,193	1,897	2,601	3,304	4,008	4,711

Mystery Park

Sensitivity on NPV per hectare

Price of biodiversity co-benefit (to be combined with ACCU price of \$13 per tonne)

% area of property in CEA

575	67	117	167	217	267	317	367
5%	-6,280	-5,260	-4,239	-3,219	-2,198	-1,178	-157
10%	-2,486	-1,466	-445	575	1,596	2,616	3,637
15%	-1,221	-201	819	1,840	2,860	3,881	4,901
20%	-589	431	1,452	2,472	3,493	4,513	5,534
25%	-210	811	1,831	2,852	3,872	4,893	5,913
30%	43	1,064	2,084	3,105	4,125	5,146	6,166
35%	224	1,244	2,265	3,285	4,306	5,326	6,347
40%	359	1,380	2,400	3,421	4,441	5,462	6,482

Moora Plains

Sensitivity on NPV per hectare

Price of biodiversity co-benefit (to be combined with ACCU price of \$13 per tonne)

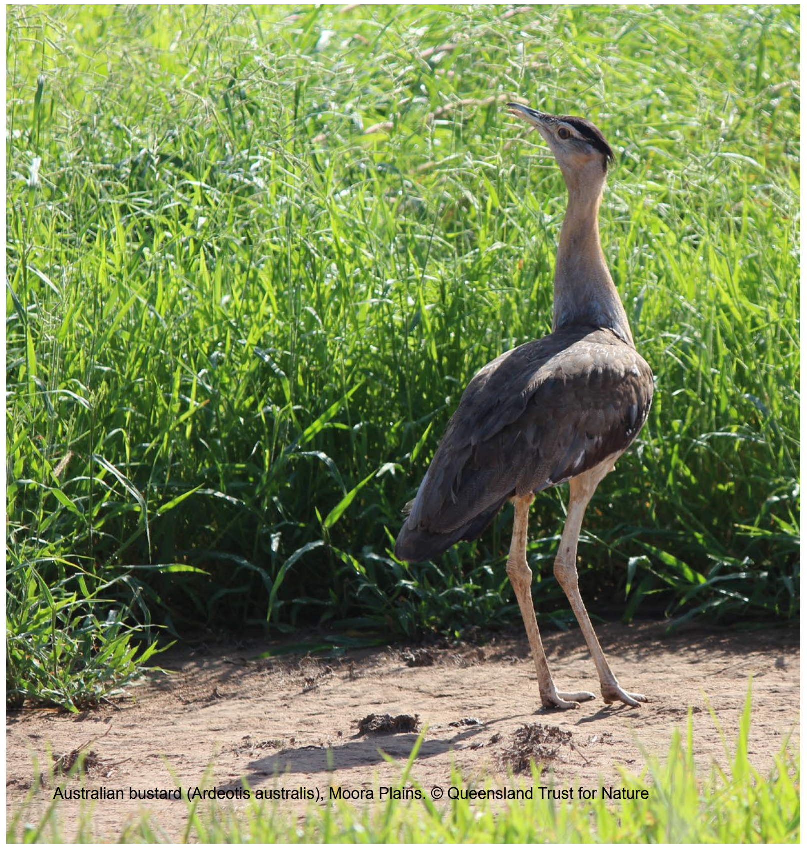
% area of property in CEA

474	67	117	167	217	267	317	367
5%	-3,721	-3,082	-2,444	-1,805	-1,167	-528	110
10%	-1,441	-803	-164	474	1,113	1,752	2,390
15%	-681	-43	596	1,234	1,873	2,511	3,150
20%	-301	337	976	1,614	2,253	2,891	3,530
25%	-73	565	1,204	1,842	2,481	3,119	3,758
30%	79	717	1,356	1,994	2,633	3,271	3,910
35%	187	826	1,464	2,103	2,741	3,380	4,018
40%	269	907	1,546	2,184	2,823	3,461	4,100

Figure 4. Sensitivity analysis on NPV per hectare for HIR carbon farming with biodiversity co-benefits.

WHAT WE FOUND

- Producers are attracted by the potential of tree carbon farming to diversify their enterprises, drought-proof their income, get a comparable return on assets and investment to their existing enterprises, and add value to their portfolio.
- Given the other starting assumptions, a combined carbon and biodiversity price in the range of $230-270 per tonne of CO2-e over the 15-year term of the co-payment under the LRF investment scheme would be required to ensure a competitive return on investment for our beef producer families (Figure 4).
- The ACCU price at the time of our pilot project was approximately $16. The ACCU price used in the model runs displayed above was conservatively assumed to be $13. Since the project finished, the price of ACCUs increased dramatically to over $30.
- The estimated costs of biodiversity surveys, assessments, verification and habitat management amounted to almost $900,000 over 15 years, with over half of this expense incurred in the first 5 years. Almost two-thirds of the estimated biodiversity cost was for improving the habitat of endangered wildlife, notably through the control of non-native plant species. These costs add substantially to the total cost of undertaking a HIR carbon farming project with biodiversity co-benefits.
- Opportunity cost (a reduction in cattle carrying capacity) was the other major contributor to total project costs, even under the 'regenerative' scenario in which cattle continue to graze under regenerating trees. As shown in Figure 3, opportunity costs increase over time as trees grow, eventually reducing pasture productivity.
- Since our pilot project finished, the LRF has developed an investment framework that includes up-front payments and annual payments to mitigate the high initial costs of embarking on a carbon farming project with co-benefits. Lower cost methods to assess and verify biodiversity co-benefits have also been developed. Both would tend to improve the business case.
- Eligible interest holder consent by financial institutions with rights on the title of a property can be difficult to secure, particularly for carbon farming projects involving vegetation. It was not clear why banks were not more supportive of carbon farming initiatives. One of the three producer families embarked on a private review of financial institutions with a view to increasing their chances of securing eligible interest holder consent in future.
- At the time of our pilot project, most financial and lending institutions operating in Queensland appeared not to recognise income generated from carbon farming in their assessments of clients' financial positions and capacity.



Australian bustard (Ardeotis australis), Moora Plains. © Queensland Trust for Nature

- Land values are also typically perceived as being impaired by increased vegetative cover on agricultural properties
- Complex registration and audit processes for carbon farming projects often means that a carbon service provider must be engaged as a contractual partner. These providers typically take a fixed percentage (18-35%) of the revenue derived from the sale of carbon credits. This increases the transaction costs associated with a carbon farming project, but acknowledges the upfront costs and risk management borne by the carbon service provider.
- Carbon farming project development takes time. It is not uncommon for carbon farming projects involving vegetation sequestration methodologies to take months or years to register.
- The tax treatment of revenue from the sale of carbon credits was unfavourable (when this project concluded):
    1. tax laws treat carbon credits as an asset, in much the same way as market shares, and ACCUs attract capital gains tax as well as income tax when sold; and
    2. income from carbon credits cannot be averaged over multiple years in the same way as other farm income. (This rule was recently amended by the federal government.)
- Greater flexibility to register both soil carbon and tree carbon farming projects in the same area would be helpful, along with opportunities to implement an environmental offset (e.g. for biodiversity) over a carbon farming area, also known as 'environmental stacking'.
- Producers were concerned about the risks of not meeting estimated carbon yields due to the potential impact of wildfires, floods or drought. Any shortfall in carbon yield must be discounted from the next audit period.
- Opportunity costs may be higher for the case study producers involved in this study, as they are all top performers in their benchmark groups and generally display healthy gross margins, ROAs and turnover figures. It is possible that other beef producers with weaker performance figures may incur lower opportunity costs and regard carbon farming as a more attractive enterprise.
- All of the participating beef producers said they engage in long-term planning. "Our family's planning horizon is 200 years" (Cameron Gibson *pers comm*). This long-term planning horizon means that participating producers were cautious about any possible restrictions on their future land-use options. Consequently, all three properties are subject to Property Maps of Assessable Vegetation (PMAVs) initiated by the producers to flexibly manage their vegetation into the future.
- The relatively short-term benefits of a carbon farming project with a 25-year permanence period must demonstrate exceptional value in the context of such a long-term planning horizon. A permanence period of 100 years for an additional 20% in income from carbon credits was not seen as attractive to our producer families because of the uncertainties it creates for future land-use options.
- Conservation covenants, in the form of Nature Refuges under the *Nature Conservation Act 1992* (Qld), over each of the beef properties were considered as a means of securing biodiversity values in perpetuity. In the end, covenants were not developed for the same reasons given above. The value proposition could not be established for carbon and biodiversity co-payments over a 25 and 15-year period, respectively, in exchange for a conservation agreement intended to remain in place in perpetuity. While a Nature Refuge agreement may lead to funding opportunities through the Queensland Government's Nature Assist program or other grants, these financial opportunities were considered unpredictable and inadequate to overcome the perceived loss of economic opportunities with respect to future land-use options.
- Following the development and lengthy testing of many different scenarios using the financial model described above, the producer families were not inclined to proceed with HIR carbon farming project development to the point of being 'investment ready'. This is because the price of the co-payment required to support a good business case for carbon farming with biodiversity co-benefits was considered too high to attract potential investors.

Hibiscus sturtii, Coonabar. © Queensland Trust for Nature

Squatter pigeon (Geophaps scripta), Mystery Park. © Queensland Trust for Nature

WHAT WE CONCLUDED

OPPORTUNITIES

- The producers told us that the opportunities presented by HIR carbon farming were attractive in principle – to diversify their enterprises, drought-proof their income, get a comparable return on assets/investment to their existing enterprises, and add value to their portfolio. Based on project experience, we concluded that a proportion of Queensland's 8,576 other beef producers operating over 50% of Queensland (129 million hectares) would share this view (Australian Bureau of Statistics, 2021).
- Management of native vegetation regrowth on grass-fed beef properties in Queensland presents challenges for balancing animal production and biodiversity conservation. This is due to the rapid rate of regrowth of previously cleared vegetation, the tendency of regrowth to thicken, and the perceived operational requirement to periodically remove or thin regrowth vegetation in order to sustain livestock production. Creating new opportunities to generate value from native regrowth is a commendable goal of carbon farming through the LRF.
- Regrowth benefits interactive mapping provides an overview of the potential areas of Queensland that are considered suitable for regrowing native forest, including carbon sequestration potential, the conservation of threatened species that may benefit from habitat expansion, and biodiversity benefits.
- Recognition of the biodiversity co-benefits of carbon farming provides a positive value-add to the generation of carbon credits, which buyers are likely to find attractive if they are priced appropriately.
- The concept of buying carbon credits voluntarily or as a polluter with regulatory obligations that bring the value-add of biodiversity enhancement may be an answer. Investors such as large pension funds show growing interest in conservation finance. However, key challenges must be addressed before greater investment is seen from these entities, including: sufficient scale of investment; and how to categorise biodiversity as an asset class in profit and loss ledgers. Is biodiversity an intangible or tangible asset? Fixed? Tradable? How is it used? Attaching biodiversity as a value-add to an existing tradable asset, such as carbon credits, is an elegant solution that overcomes some of the issues related to defining a credible financial accounting position for biodiversity alone.
- Beef producers pride themselves on their biodiversity stewardship. There is strong interest in the development of markets and other schemes that recognise and reward not only future increases in biodiversity stewardship on-farm, but the outcomes of past land management that delivers high conservation values right now.
- There is an emerging market for certified carbon-neutral beef both in Australia and globally. Consumers are increasingly aware of the carbon footprint of beef production and are making dietary choices to reduce their contribution to environmental impacts. Several vertically integrated beef producers in Australia are now supplying beef with carbon-neutral claims into Australian and global markets, including NAPCo's Five Founders beef and Flinders & Co. If a beef producer implements a carbon farming project on their land and sells the credits, these credits are no longer available to claim a reduction in the beef business' emissions. That would be considered double counting and is described on the Regulator's web page in relation to the safeguard mechanism. If a beef producer has a carbon farming project and wishes to make a carbon-neutral beef production claim or label, they can reserve (and not sell) carbon credits to achieve carbon neutral certification.
- Some downstream customers of Australian beef are committed to sourcing their supplies from farms that do not clear forests – known as 'deforestation-free' or 'zero deforestation' sourcing. These commitments have been documented in various forms over the past 10 years, including the New York Declaration on Forests, the Glasgow Leaders Declaration on Forests and Land Use, the UN Sustainable Development Goals (SDGs) and the Consumer Goods Forum.
- Meat and Livestock Australia (MLA) is working with the University of Queensland and WWF to develop a framework to enable producers to be recognised for their environmental performance, including verified claims for carbon balance credentials and tree cover as an indicator of deforestation-free production.

CHALLENGES

Many of the challenges for beef producers engaging in carbon farming enterprises in Queensland would be familiar to anyone in the land sector undertaking a carbon offset project. These have been reported in numerous publications and have been identified as priority areas of work for the industry through the year 2030 (Carbon Market Institute, 2017).

Price versus cost

- One key challenge is to bring costs down. Based on our starting assumptions and the estimated project costs, as described above, we concluded that ACCUs with biodiversity co-benefits would need to be priced in the order of \$230–270 per tonne CO_2e over the 15-year term of the co-payment under the LRF investment scheme as it existed at the time, in order to generate a meaningful return on investment for our beef producer families. This aligns with the findings of Davison and Keogh (2011), who argued that in order for a beef property with an annual turnover of $100,000–200,000 to match business-as-usual income, the carbon price needed was approximately $270/tonne CO_2e, while for a farm generating more than $400,000 annual turnover, the carbon price required would be $230/tonne CO_2e.

- If ACCUs were to increase in price, for instance due to increased market demand, the biodiversity co-payment price could be lowered. However, our estimates of the cost of generating biodiversity co-benefits were so large that a very substantial increase in the market price of ACCUs would be required to make an appreciable difference.
- Extending the co-payment term to match the carbon farming crediting period of 25 years may lower the combined carbon credit and co-payment price somewhat but not sufficiently to re-balance the proportionate costs of biodiversity co-benefit management and verification.
- The transaction costs of undertaking carbon farming projects (with or without biodiversity co-benefits) are high. The cost of registering, managing and auditing projects is generally fixed, regardless of size, and typically managed through a contractual arrangement with a carbon service provider. Economies of scale are needed to realise sufficient returns on investment in land-based projects. The concept of a co-payment for biodiversity co-benefits does not, by itself, overcome this scale issue. Traditionally, vegetative carbon farming projects require property sizes in the thousands of hectares to be economically viable, owing to the relatively high fixed costs of carbon project management. Our producers' properties are in the order of 5,000–10,000 hectares, and would not generally attract the interest of carbon service providers as partners or investors.

Hibiscus sp., Coonabar. © Queensland Trust for Nature

- The estimated costs of additional management activities to support measurable and verifiable biodiversity co-benefits were substantial, in part because the project went beyond LRF requirements. There was much debate among project partners about whether biodiversity co-benefits should be considered a by-product of carbon farming (requiring measurement but little to no additional management), or if major management interventions are required to deliver significant gains in biodiveristy alongside carbon yields. In the latter case, it may be possible to reduce biodiversity management costs if tasks are carried out by landholders, rather than by contractors, and/or by using fire to control weeds.
- The concept of co-payments for biodiversity co-benefits developed by the LRF aims to increase the value proposition for landholders across Queensland with respect to carbon farming, but has not been shown in our pilot study to overcome issues of implementation and opportunity cost. Since concluding this pilot project, the LRF has refined its methodology for co-benefit accounting through the publication of a Co-benefits Standard.

Tax Implications

- Income from the sale of ACCUs generally arrives once every five years. This is because it is financially unviable to arrange measurement and audits of carbon yields more frequently than the maximum five-year interval caps set by the Clean Energy Regulator. At the time this project was carried out, income from the sale of carbon credits could not be treated the same as regular on-farm income, as carbon credits were seen as tradable assets similar to marketed shares (equities).
- At the time of publication, reports indicated that the Federal Government would make changes to the tax accounting treatment of income from the sale of ACCUs, such that it can be regarded the same as regular farm income. Since this project commenced, the LRF also established a regime of up-front and annual payments to mitigate the long time frames required to realise a return on investment in carbon farming projects.

Greater glider (Petauroides volans subsp. Volans), Coonabar. © Queensland Trust for Nature

- Capital gains tax applies to carbon credits that are withheld from the market and appreciate in value.
- While there are several opportunities for tax relief for conservation management activities on-farm, they do not apply when income is derived from that conservation activity.

Complexity of Carbon Farming with Co-benefits

- The complexity of carbon farming methods and government funding arrangements can be discouraging and confusing. Our producer partners observed that this may lead to serious misconceptions, false assumptions and potentially perverse outcomes. For example, government rules that exclude areas with pre-existing mature vegetation from earning carbon credits could lead some landholders to clear existing regrowth and establish carbon projects in other areas, where there is no or less mature vegetation, resulting in net losses of both carbon and biodiversity in the short-term.
- In qualifying the biodiversity assets and activities required to support beef producers through carbon farming and biodiversity co-benefit projects, it became apparent that the concept of biodiversity co-benefits as a value-add requires further development. In particular, the following are needed:
    1. a means of estimating the future 'yield' of the biodiversity asset over time, analogous to the carbon yield estimates that are required for a carbon farming project;
    2. a means of recognising biodiversity yield as a credit; and
    3. a means of determining the baseline biodiversity co-benefits generated by alternative carbon farming methods in different contexts, as well as a realistic suite of activities that would deliver additional co-benefits.

Land Valuation

- Current negative perceptions of vegetation on agricultural land by many professional land valuers results in decreased land values as vegetative carbon increases. This unhelpful reduction in the value of a producer's primary asset, against which their loans may be secured, caused great concern for our beef producers, along with issues around succession planning, as the value of the primary asset shifts over time.
- An apparent disconnect exists between agricultural financial institutions, their environment and sustainability policies, and the practical support for carbon farming projects on agricultural lands. Financial institutions appear not to recognise the income derived from carbon farming as part of their assessment of clients' financial position, and they are slow or unobliging when requested to provide eligible interest holder consent where they hold an interest on the title of the land.

Red-winged parrot (Aprosmictus erythropterus), Moora Plains. © Queensland Trust for Nature

WHAT WE EXPERIENCED

- A strong project team bond and teamwork developed during the pilot project, with high levels of trust and knowledge-sharing between partners. All partners invested considerable energy and time. The beef producers, in particular, spent many hours reviewing documents, discussing concepts, opportunities and challenges. Co-contributions by all project partners were also considerable, resulting in a project value of close to $400,000 when in-kind investment is acknowledged.
- All project team members experienced a steep learning curve. They increased their understanding of carbon farming under the Climate Solutions Fund, and co-benefits with co-payments offered by the LRF model.
- Non-beef producer partners gained a deeper understanding of the principles of regenerative grazing, most notably the short time period that any given paddock is grazed in a one-year period. A graze period of 1 to 2 days is common for each of the many watered paddocks in such innovative grazing systems, which is shortened or lengthened according to forage availability and grass growth, among other factors. This allows regrowth to increase largely unhindered by grazing, along with a principle of 'let all plants grow' to increase biodiversity. The greater the biodiversity, the more robust an ecosystem is, and the greater the exchange and transfer of nutrients to support plants in pastures.
- All project partners were excited by the prospect of learning more about the flora and fauna that beef properties support. Each property revealed flora and fauna species of conservation interest, with threatened species including the koala, greater glider and squatter pigeon. Producer families and their children participated in flora and fauna surveys, learned flora and fauna survey methods, and the taxonomy of native animals and plants.
- Project partners enjoyed an amazing opportunity to tour all three beef properties and discuss grazing management and history, carbon farming opportunities and challenges, values and value management.
- Robust discussions covered a number of significant issues, including:
    - land values, land valuations and valuers, and the perception of thickening vegetation devaluing productive land. It was acknowledged, however, that land valuer perceptions are gradually shifting to perceive vegetation in a more positive light;
    - eligible interest holder consent;
    - recognition of prior stewardship of biodiversity;
    - the level of active management required to make gains in biodiversity that are matched to carbon credits; and
    - the opportunity costs of the HIR carbon farming method, both with (regenerative) and without (environmental) ongoing cattle grazing.
- Project delays were experienced when extremely wet weather made the properties impassable for field surveys during February and March 2020. Further delays due to COVID-19 restrictions interrupted travel from March to July 2020 for Queenslanders, and until December 2020 for the Victorian-based Greenfleet partners. This prevented ground-truthing of draft FULLCAM HIR carbon yield estimates on the three properties.
- The LRF Investment Round 1 opened from 28 January–29 April 2020. At this time, our pilot project was into the seventh of its 12-month lifespan. Producer partners deliberated on whether we should accelerate project work in order to finalise carbon farming and biodiversity co-benefit projects in time for submission to Round 1, and eventually chose to complete the pilot before developing formal project proposals for consideration by the LRF.

Red-winged parrot (Aprosmictus erythropterus), Moora Plains. © WWF-Australia

ANNEX: SUMMARY DATA ON THE CASE STUDY PROPERTIES

TABLE A1. SUMMARY DATA FOR MOORA PLAINS, GOGANGO, QUEENSLAND.

Size: 3,555 hectares

Number of paddocks: 82

Average annual rainfall: 615 mm

Main cattle enterprises: growing out (trade cattle)

2020 carrying capacity: 1,200-1,400 LSU

Biodiversity surveyed: 148 species of native plants, 72 species of native animals

Key species and habitats for biodiversity co-benefits: Squatter pigeon (Econd: 53); gilgai (Econd: 63), koala habitat (Econd: 23)

2020 Accounting for Nature overall score: 47

Gross 25-year HIR carbon yield estimate (environmental) per ha: 108.61 tonnes CO_2-e

Gross 25-year HIR carbon yield estimate (regenerative) per ha: 64.84 tonnes CO_2-e

Estimated 2045 opportunity cost (animal production, maximum): -$1.9 million

Estimated annual land value decrease over 25 years: - $7.224 million

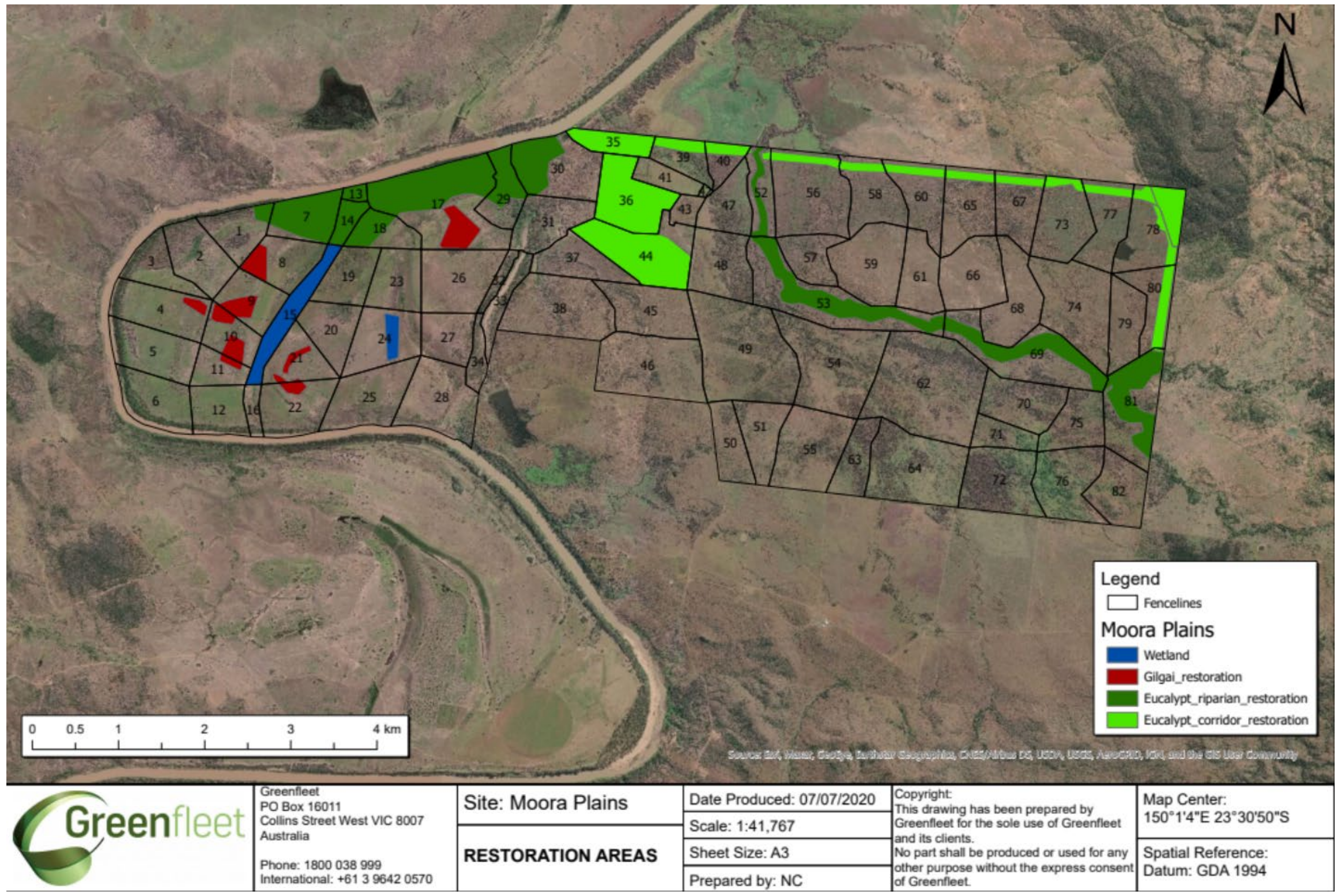


TABLE A2. SUMMARY DATA FOR COONABAR, ROLLESTON, QUEENSLAND.

Size: 6,781 hectares

Number of paddocks: 106

Average annual rainfall: 650 mm

Main cattle enterprises: growing out (trade cattle)

2020 carrying capacity: 2,000 to 3,500 LSU

Biodiversity surveyed: 165 species of native plants, 73 species of native animals

Key species and habitats for biodiversity co-benefits: gilgai (Econd: 47); koala (Econd: 44), greater glider (Econd: 28)

2020 Accounting for Nature overall score: 45

Gross 25-year HIR carbon yield estimate (environmental) per ha: 215.55 tonnes CO_2-e

Gross 25-year HIR carbon yield estimate (regenerative) per ha: 129.14 tonnes CO_2-e

Estimated 2045 opportunity cost (animal production, maximum): -$5.512 million

Estimated annual land value decrease to 2045: -$7.179 million

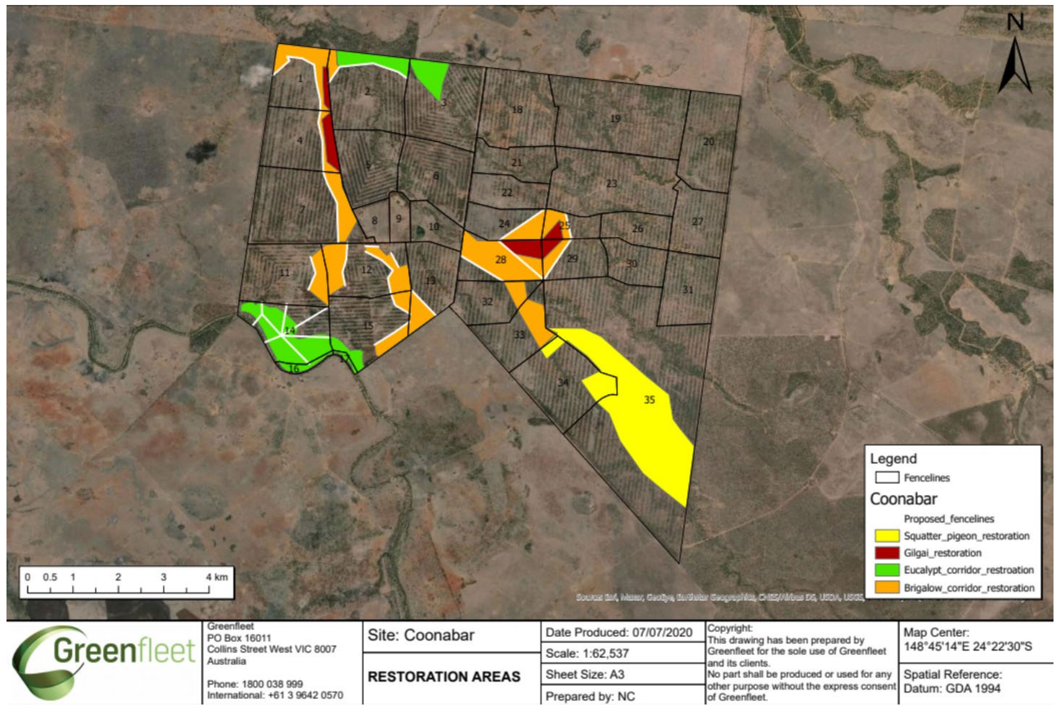


TABLE A3. SUMMARY DATA FOR MYSTERY PARK, ST LAWRENCE, QUEENSLAND.

Size: 10,686 hectares

Number of paddocks: 101

Average annual rainfall: 1,050 mm

Main cattle enterprises: agistment, custom grazing, breeding, growing out (trade cattle)

2020 carrying capacity at 2020: 5,000 LSU

Biodiversity surveyed: 165 species of native plants, 85 species of native animals

Key species and habitats for biodiversity co-benefits: **squatter pigeon:** (Econd: 87), koala (Econd: 64), greater glider (Econd: 54)

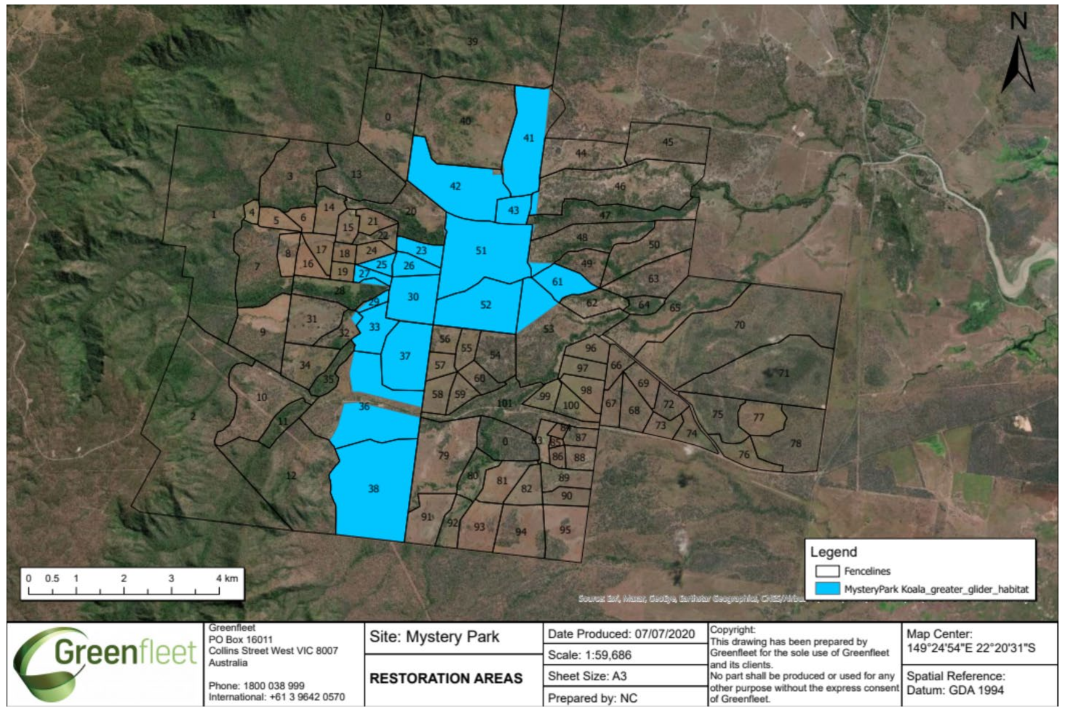
2020 Accounting for Nature overall score: 65

Gross 25 year HIR carbon yield estimate (environmental) per ha: 100.82 tonnes CO_2-e

Gross 25 year HIR carbon yield estimate (regenerative) per ha: 60.37 tonnes CO_2-e

Estimated 2045 opportunity cost (animal production, maximum): -$1.8 million

Estimated annual land value decrease to 2045: -$5.577 million



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