Final report

Public

ESG pathways for a vertically integrated organic supply chain – Final Report

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Abstract

The project was undertaken to address the growing need for enhanced sustainability and environmental performance within the agri-food supply chain. The project aimed to develop a vertically integrated organic supply chain that could serve as a model for the broader red meat industry. The primary objectives included establishing a carbon footprint for the supply chain, assessing biodiversity and natural capital, and developing strategies for emission reduction and sustainability improvements.

The project was performed through a multi-phase approach involving baseline assessments, scenario modelling, and the implementation of sustainability actions. Key methodologies included carbon footprint analysis, biodiversity assessments using the NV-10 method, and the development of extension and adoption materials.

Key results from the project included the completion of a comprehensive carbon footprint for the supply chain, identification of market opportunities for well-credentialed red meat, and the development of new products with sustainability attributes. The project also produced extension materials to share findings with the broader industry.

The benefits to the industry include improved understanding of sustainability practices, enhanced market opportunities for certified products, and practical knowledge for implementing emission reduction strategies. These outcomes support the industry's goals of reducing greenhouse gas emissions and enhancing biodiversity.

Executive summary

Growing consumer, investor and societal expectations are driving industries—including red meat—to improve environmental, sustainability and ethical performance. However, the red meat sector faces challenges in meeting these demands due to limitations in data, technology and cost-effective emissions abatement and measurement capability for assessing regenerative production practices. Hewitt aims to be a global leader in sustainable branded products and already markets goods under Organic, Regenerative Organic and Carbon Neutral credentials. In line with industry goals such as carbon neutral by 2030 and increasing consumer interest in nature-positive production, Hewitt has initiated a multi-stage sustainability plan.

Hewitt manages 14 extensive grazing properties across Queensland (QLD), Northern Territory (NT) and New South Wales (NSW), covering 2.25 million hectares (ha) and running approximately 170,000 livestock. Most animals are certified organic, and the business also produces wool. Scope 3 emissions from purchased inputs, particularly livestock and meat, are significant. To address this, Hewitt is working with the MLA Donor Company on a multiphase project involving baseline assessments of carbon, biodiversity and natural capital.

Objectives

The project had the following aims, covered in this final report:

- Complete a carbon footprint for the Hewitt Cattle supply chain (scopes 1, 2 and 3), covering Hewitt Cattle direct control operations (stations and facilities) and third party purchased cattle and sheep.
- Baseline profile of biodiversity, natural capital, groundcover and relevant infrastructure for selected farms in the supply chain.
- Determine and establish targets and scale of sustainability strategies across the various elements baselined.
- Investigate feasibility of vegetation (insetting and offsetting) options for the supply chain, including emissions reduction and sustainability improvement strategy for direct controlled and third-party cattle and sheep suppliers to achieve identified targets.
- Identify market opportunities for well-credentialled red meat, including access and verification requirements for certification with selected bodies.
- Develop an overview of new products commercialised within the project (specific stock keeping units, illustration of product packaging mock ups, indication of initial forecast volumes and sales achievement to evaluate impact of project).
- Identify lessons learned in developing a new value chain pursuing significant sustainability, regenerative agriculture, and emission reduction attributes beyond carbon neutrality.
- Develop extension and adoption material for the supply chain and broader industry including five specific case studies sharing findings from pre-feasibility, baseline and emission reduction actions.

Methods

The project employed a comprehensive and multi-phase methodological approach to achieve its objectives. The key methods included:

- Carbon Account and Carbon Footprint Analysis: Baseline carbon assessments were conducted across the supply chain using established GHG accounting standards and covered livestock and land sector emissions, including scope 1, 2 and 3 emission sources.
- Natural Capital Assessment (NCA) including Biodiversity Baseline: A detailed biodiversity assessment (baseline) was undertaken using the Accounting for Nature NV-10 method. These detailed biodiversity results were then fed into a broader NCA including a range of other assets relevant to production and nature in general. This technique enabled the quantification of ecological value and provided a basis for evaluating improvements. A scalable mapping program was developed covering key natural capital assets and risks. Screening assessments of deforestation and LU, dLUC were undertaken to examine future market requirements and this is discussed in the report.
- Net Emission Reduction Plan: A plan was developed in consultation with the company to deliver emission reduction at levels aligned to investor and customer expectations. Opportunities were developed through to pilot implementation phase.
- Extension and Adoption: Targeted workshops were developed and implemented with a large number of supplier stakeholders. Educational and practical materials were designed to facilitate the adoption of sustainability practices across the broader industry. These materials were also aimed at sharing the findings and methodologies used in the project.

Results

Carbon account results are shown in Table 1. A comparison of scope 1 & 2 enterprise emissions to historic results is shown in Figure 1.

Table 1. Carbon account results –2022 and 2023

Emission source	**2022**	**2023**
	t CO_2-e	
Scope 1 & 2 emissions from livestock and services	220,082	220,197
Scope 1 – LU, LUC vegetation and soil emissions	n.r	87,571
Scope 1 – LU, LUC vegetation and soil removals	n.r	28,482
Net scope 1 and 2 emissions	n.r	279,286
Scope 3 (excl. LU, LUC)		501,929

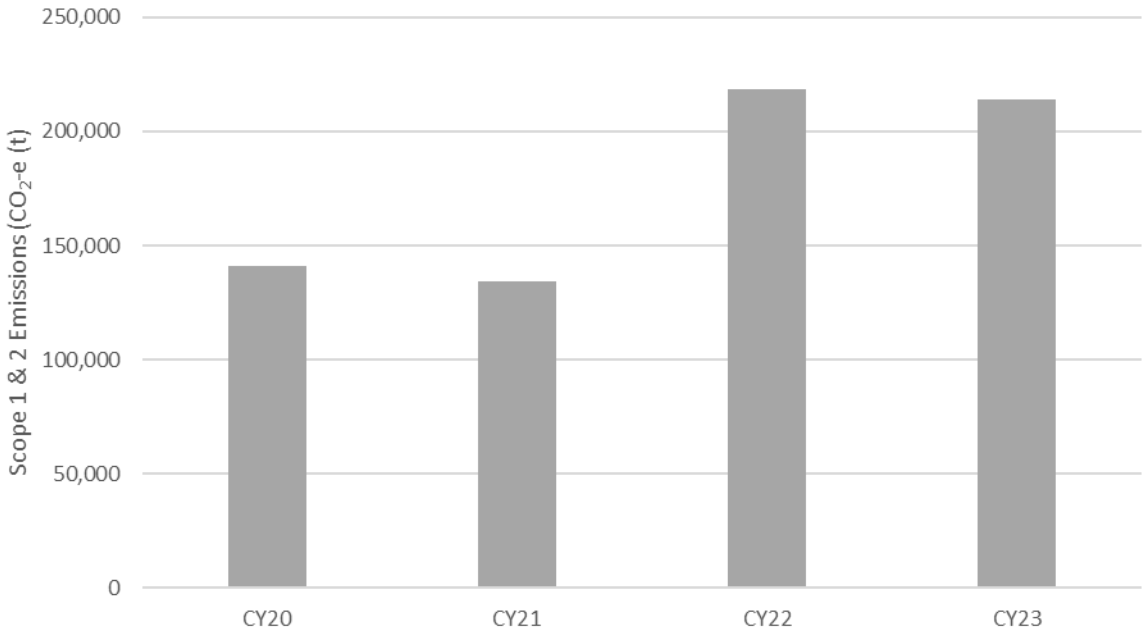

Figure 1. Historic Scope 1 and 2 enterprise emissions (t CO_2-e)

Emissions were principally driven by livestock (enteric methane, 93%) and changes between year were associated primarily with herd acquisitions along with less impactful seasonal and market fluctuations .

Scope 3 emissions are significant within the Hewitt supply chain. The quantities of livestock and meat purchased into the supply chain are the primary contributors. The CY22 scope 3 position was impacted due to a property acquisition and the associated livestock inventory. The CY23 analysis had increased coverage over CY22, resulting in further categories receiving allocation.

Table 2. Scope 3 GHG results –2022 and 2023

Category	Description	2022		2023	
		t CO_2-e	% contribution	t CO_2-e	% contribution
1	Purchased goods and services	838,568	97%	434,054	86%
2	Capital goods	n.r		3,339	1%
3	Fuel and energy-related activities	1,214		1,224	<0.5%
4	Upstream transportation and distribution	7,001	<0.01%	14,141	3%
5	Waste generated in operations	n.r		91	<0.5%
6	Business travel	n.r		1,067	<0.5%
7	Employee commuting	n.r		388	<0.5%
8	Upstream leased assets	n.r		n.r	
9	Downstream transportation and distribution	n.r		n.r	
10	Processing of sold products	15,660	2%	21,326	4%
11	Use of sold products	n.r		9,096	2%
12	End of life treatment of sold	n.r		n.r	

13	Downstream leased assets	n.r		6,000	1%
14	Franchises	n.r		n.r	
15	Investments	n.r		11,204	2%
Total		**862,443**	**100%**	**501,929**	**100%**

Product carbon footprint (CF): The reported CFs were 16-17.2 kg CO_2-e for the operations, and 12.6 kg CO_2-e for the weighted average of young cattle supplied to Hewitt Foods. There was 73% variation between the highest and lowest performing cattle supplied to Hewitt Foods based on variation in weight-for-age and breeder herd productivity, suggesting opportunities to reduce the carbon footprint through productivity improvements in the supply chain. Sheep meat CFs were 10.3-10.7 kg CO_2-e kg LW^{-1} for Hewitt operations, and 7.0 kg CO_2-e LW^{-1} for supply into Hewitt Foods. CFs were similar to other supply chains operating in the same regions.

Net emission reduction pathway including insetting

The net emission reduction pathway outlined the activities required to deliver substantial emission reduction in the short- to mid-term (to 2035) and has the ambition to align with SBTi FLAG commitments, specifically the 2.4% p.a. emission intensity reduction (commodity pathway, beef). This has not been set as a target for the company at the present stage.

For internal purposes, and as a result of implementing pathway two presented in this report, annualised emission reductions of **19% by 2035 (compared to the 2022 company baseline)** were considered achievable (pathway 2, 50% implementation). While these reductions were not linear, the annualised reduction rate was equivalent to **1.6%** in this scenario.

Higher net reductions were achieved under the pathway where significant regeneration was achieved. Still, this project has some risks and is likely to remain uncertain, particularly in the next five years (to 2029), while final approvals are developed and early regeneration is established. Additionally, separate from the FLAG-aligned target, the business aims to achieve at least **a 0.1% reduction in absolute GHG emissions**.

Pathway 1 delivered a range in abatement outcomes to 2035 of between 58% and 53% (compared to 2022 scope 1 and 2 baselines), with the range relating to an implementation success rate of 75% or 50% for all other abatement programs. Reductions in emission intensity were equivalent to the total reduction. However, reductions in emission intensity could also be achieved while still expanding beef production through productivity measures, making this a far more flexible target than an absolute reduction target.

Pathway 2 delivered a range in abatement outcomes to 2035 of between 25% and 19% (compared to 2022 scope 1 and 2 baselines), with the range relating to an implementation success rate of 75% or 50% for all other abatement programs. Reductions in emission intensity were equivalent to the total reduction. However, reductions in emission intensity could also be achieved while still expanding beef production through productivity measures, making this a far more flexible target than an absolute reduction target.

Both programs required significant capital investment, operational expense, and management focus and delivered substantial abatement outcomes. The abatement curves were not linear (as shown in

Figure 1). On an annualised basis, and taking the more conservative 50% implementation success rate, abatement was 1.6% p.a. (path 2, excluding Narwietooma) and 4.4% (path 1, including Narwietooma). Both were considered industry-leading and will be less constraining if maintained as emission intensity targets.

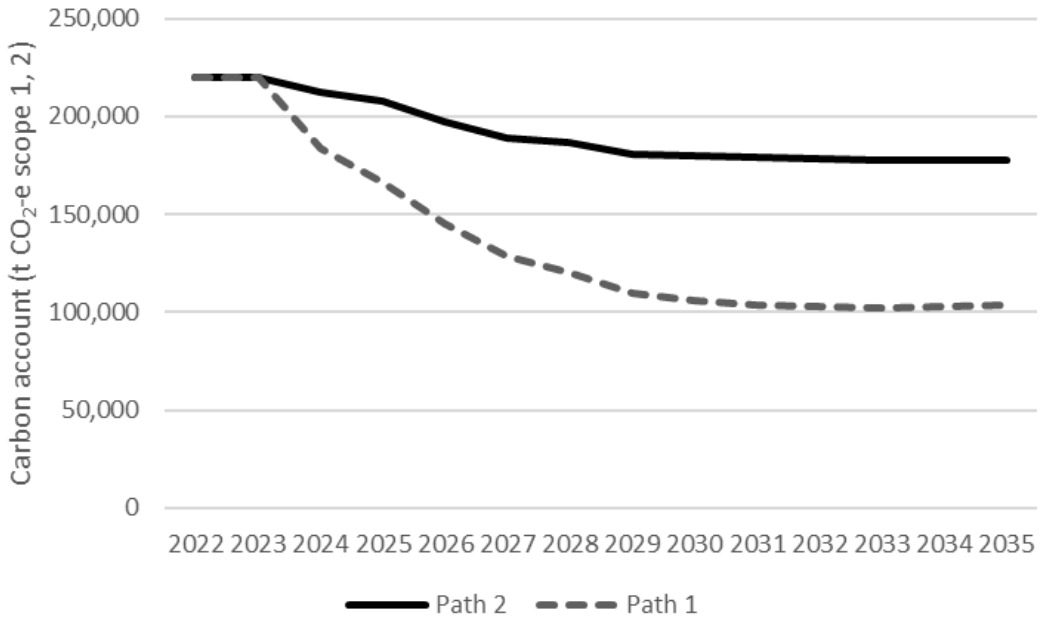

Figure 2. Scope 1 and 2 abatement pathways, showing high regeneration pathway (path 1) and lower regeneration pathway (path 2) scenarios with a 50% implementation rate

Table 3 Mitigation shortlist to support pathway implementation

Strategy	**Peak abatement by 2035 (net scope 1 & 2 emissions)**	**Indicative cost**	**Activities to achieve change**
Herd productivity	10.9%	Management and Capital intensive: productivity and asset value benefits expected.	Herd management to reduce numbers of unproductive breeding animals on stations – likely investment, TBC. Development of a new intensive finishing facility with irrigated organic pasture and conventional feedlot – likely investment of $50-150M.

Leucaena pasture	0.6%	Capital intensive: productivity and asset value benefits expected. Lower cost compared to supplements.	Staged planting of 10,000 ha (commenced). Implement a system to account for abatement.
Anti-methanogenic feed supplement	8.3%	High-cost abatement: current est. between $100-400 t CO_2-e.	Implement new supplement feeding through block/water dosing.
Genetic selection for reduced feed intake	2.1%	Cost-neutral if a balanced breeding program can be achieved.	A genetics plan required, in consultation with bull breeders and possible testing.
Genetic selection for reduced methane	2.1%	Unknown. Dependant on the breeding strategy.	A genetics plan required, in consultation with bull breeders.
Solar	0.2%	To be determined.	Continue cost-effective investment.
Flock productivity - sheep	0.5%	Management intensive, productivity and asset value benefits expected.	Pasture improvement, irrigation, flock management for increased meat/wool.
Anti-methanogenic forages	0.1%	Detail pending, may be lower cost compared to supplements.	Selectively plant low methane brassicas/plantain in southern sheep.
Genetic selection for reduced methane	0.1%	Unknown. Dependant on breeding strategy.	Genetic selection for new traits in the sheep flock.
Soil carbon program	2.2%	The cost of compliance may be $15-50 t CO_2-e depending on sequestration rate.	Develop and implement soil carbon projects on 12,000 ha.
Vegetation carbon program (high and low scale implementation)	42% (8.4%)	Pending company-specific costings. 106,000 ha scale. Indicative costs from other projects suggest <$5 t CO_2-e to as high as $100 t CO_2-e with key dependencies related to long-term stocking rate and asset value and risk to abatement from lower yields.	Narwietooma regeneration project registered, pending final approvals from the regulator. Management plan and costing to be developed pending approvals.

NOTE: Estimated peak abatement rates are not equal to the average abatement rates and are not all cumulative. The sum of these percentages does not equal the outcomes of the pathway. These values are provided to show the relative contribution of each activity

Natural Capital Assessment (NCA) and Biodiversity Baseline

Biodiversity Baseline: Detailed assessments were conducted across Hewitt's properties, covering around 2 million ha in NT, QLD, and NSW. The condition of native vegetation was measured using Econd scores, with properties of high production value (e.g. Warilba and Brewarrana) scoring the lowest, and properties such as Yorkshire and Coolreagh (with modest relative productive values) having a higher proportion of natural values.

Supply Chain Pilot (full NCA): To assess other natural capital assets, including those directly related to production within the Hewitt Estate and largest suppliers, a scalable method for mapping properties and conveying important metrics regarding natural capital management was developed. This included

creating an asset register generally compliant with the TNFD 'LEAP' process, with impact/dependency assessments and risk/opportunity assessments of over nine directly measured assets undertaken for over 50 properties. The results of this assessment included mini-reports for all assessed properties mapping with tabulated results, with supply chain results aggregated. In general, the Hewitt Estate and its largest producers performed above land within each's properties locality (in particular in regards to pasture biomass), although, as expected, a higher volume of nature-related impacts was observed in eastern properties with higher production value.

Larger rangelands properties (due to their size and the use of weighted averages based on land size) influence supply chain scores to a large degree. Based on these results a range of risk mitigation measures were provided to improve sustainable production on each property.

In general, the overall NCA provided valuable insights into the environmental performance of Hewitt's supply chain, and forms the basis of a repeatable assessment framework that can be used to guide and report on management and performance.

Supply Chain Engagement

Hewitt Foods, in collaboration with Soil Land Food and Integrity Ag, facilitated a targeted supply chain engagement program focused on soil health and carbon management. Throughout 2023 and into 2024, Soil Land Food delivered workshops, field days, and one-on-one support to pastoralists, graziers, and croppers, building capacity to improve drought resilience, restore soil health, reduce synthetic inputs, and enhance carbon levels. In parallel, Integrity Ag piloted carbon-focused content with key suppliers and station managers, delivering tailored workshops and refining messaging through ongoing feedback. These activities supported the adoption of improved land management practices across Hewitt's supply base and aligned with broader industry sustainability goals. Key outcomes included over 200 participants taking part in some aspect of the engagement program.

Conclusions

This project demonstrated large-scale carbon accounting aligned with emerging regulatory frameworks, including Climate-Related Financial Disclosures. Product carbon footprints were calculated for both Hewitt's production and supply chains, revealing variations based on procurement patterns and animal types. Notably, land use (LU) and direct land-use change (dLUC) emissions increased net emissions due to legal regrowth clearing practices, though removals from regeneration was underpredicted because of a lack of suitable methods on the arid zone properties. However, current insetting methods are underdeveloped, limiting verification and implementation.

An emissions reduction plan was developed, acknowledging that meaningful abatement will be a long-term effort given high costs, slow rates of change, and evolving investor and market expectations. Climate modelling highlighted the need for substantial methane reductions to return to 2005 warming levels by 2050. Workshops and footprint assessments across the supply chain identified productivity-based emissions reductions of 10-11% over 10 years, though supplier engagement remains limited due to lack of market incentives. A bespoke model was developed to improve supplier carbon footprint accuracy with reduced data requirements.

Detailed NCAs established environmental baselines but were not easily repeatable due to cost. To overcome this, a program based on spatial assessment with desktop verification was developed and piloted, which provided meaningful insight to landholders and verified measurement of regenerative practices for customers.

The program delivered new insights at business, supply chain and industry level. Key opportunities emerging from the program include:

1. A robust measurement framework for the company for carbon and nature reporting, which meets the new requirements for climate disclosures of scope 1, 2 and 3 emissions.
2. Scalable assessment of natural capital, regenerative practices and key emission performance including product carbon footprint at supply chain scale. This new capability can be leveraged to support increased brand attributes and product value.
3. An emission reduction plan identifying the most prospective options and realistic emission reduction predictions to 2035.
4. A series of recommendations to guide future improvement at company and industry scale, including opportunities for collaboration on insetting, emission reduction and improved biodiversity.

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1. Background

Globally, there is a continuously growing trend amongst consumers, investors and broader society to address challenges relating to environmental, sustainability, and ethical performance within all industry sectors. All industry sectors, including agri-food supply chains, are expected to enhance their sustainability credentials, including reducing greenhouse gas (GHG) emissions, enhancing biodiversity and natural capital. The red meat industry faces challenges in meeting these expectations due to the challenges in data collection, measurement and verification within production systems, coupled with the difficulty in achieving emission abatement due to the constraints related to technology availability, operational integration, and expense.

Hewitt has a goal to be a global leader in sustainable brand products, and to support this, the company currently markets products with Organic, Regenerative Organic and Carbon Neutral credentials. The company also has investor-led goals in carbon reduction and sustainable land management. Given industry commitments such as carbon neutral by 2030 and shifting consumer expectations towards nature positive production, Hewitt has developed a plan to address these elements for their supply chain, and to provide a leadership role to the broader red meat industry through extension and adoption. Any project needs to begin with determining the baseline state for the supply chain (at individual enterprise level), and then developing sustainability improvement strategies such as reduced or sequestered carbon and enhanced biodiversity outcomes. The implementation and execution of these strategies are then able to be utilised in an adoption context, to provide practical knowledge and capability to broader industry.

Hewitt operates 14 extensive beef cattle and sheep grazing properties across Queensland (QLD), Northern Territory (NT) and New South Wales (NSW). These properties cover over 2.25 million hectares (ha) of grazing land and carry approximately 170,000 head of cattle and sheep. Both cattle and sheep progress through the integrated property network to reach market outlets. Most Hewitt livestock are certified organic and a high proportion are processed under contract and sold into the Hewitt organic brands. Depending on markets and seasonal conditions, livestock are also sold to conventional live or slaughter markets. Additionally, the business sells wool from sheep flocks.

Hewitt buy a wide range of inputs, which have associated scope 3 emissions. These include regular purchases for operating the stations and other facilities such as fuel and livestock feed, through to purchased livestock, which enter the business at 3 junctures, (1) onto the stations, (2) at point of slaughter, or (3) as boxed product. While all purchased inputs are associated with scope 3 emissions, purchased livestock and meat are the largest scope 3 emissions.

Hewitt is pursuing significant sustainability, regenerative agriculture, and emission reduction opportunities for the supply chain, including new opportunities to certify performance for marketing purposes. To achieve these goals, a multiphase approach has been developed, encompassing both research and adoption elements through partnership with the MLA Donor Company.

Initial stages included conducting a baseline assessment of Hewitt's beef and lamb supply chain, including a carbon footprint, natural capital and biodiversity assessment. Stage 1b will develop a supply chain opportunities plan, including net emission reduction and biodiversity/natural capital across the Hewitt portfolio to improve understanding and knowledge of natural values. For carbon, this will include projection and scenario modelling. It will also cover an assessment of market requirements and opportunities, including identification of suitable verification systems for carbon and natural capital to meet customer needs. Stage 2 will translate the stage 1 outputs into extension

and adoption activities to implement sustainability actions across the supply chain and extend findings to producers outside this supply chain. These will include the assessment and potential implementation of emissions reduction actions and the identification of opportunities for insetting and generation of offsets, and opportunities to improve biodiversity and natural capital.

The project was undertaken by Integrity Ag, Bush Heritage, Soil, Land and Food, and Hewitt, in collaboration with the MLA Donor Company program.

2. Objectives

The project had the following aims, covered in this final report:

- Complete a carbon footprint for the Hewitt Cattle supply chain (scopes 1, 2 and 3), covering Hewitt Cattle direct control operations (stations and facilities) and third party purchased cattle and sheep.

  Status: Complete (for CY2022 and CY2023)

- Baseline profile of biodiversity, natural capital, groundcover and relevant infrastructure for selected farms in the supply chain.

  Status: Complete

- Determine and establish targets and scale of sustainability strategies across the various elements baselined.

  Status: Under review

- Investigate feasibility of vegetation (insetting and offsetting) options for the supply chain including emissions reduction and sustainability improvement strategy for direct controlled and third-party cattle and sheep suppliers to achieve identified targets.

  Status: Complete

- Identify market opportunities identified for well-credentialled red meat, including access and verification requirements for certification with selected bodies.

  Status: Complete

- Develop an overview of new products commercialised within the project (specific stock keeping units, illustration of product packaging mock ups, indication of initial forecast volumes and sales achievement to evaluate impact of project).

  Status: Complete

- Identify lessons learned in developing a new value chain pursuing significant sustainability, regenerative agriculture, and emission reduction attributes beyond carbon neutrality.

  Status: Under review

- Develop extension and adoption material for the supply chain and broader industry including five specific case studies sharing findings from pre-feasibility, baseline and emission reduction actions.

  Status: Complete

3. Methodology

3.1. Carbon Baseline

This project completed a cradle to consumer carbon footprint (scope 1, 2 and 3 emissions) and a carbon account focused on scope 1, 2 and 3 emissions from Hewitt owned enterprises for 2022 and 2023.

This section outlines methods for the carbon account and product carbon footprint and their data sources.

3.1.1. GHG accounting standards

This report uses the following precedent documents:

Australian National Greenhouse Gas Inventory – referenced here as the National Inventory Report (Department of Industry Science and Resources, 2022) for methods to determine agricultural emission sources, and some model input data.

Australian National Greenhouse Accounts (NGA) for applicable scope 1 and 2 emission factors and/or calculation methods.

GHG Protocol Agricultural Guidance (WRI & WBCSD, 2011) and GHG Protocol Scope 3 (WRI & WBCSD, 2022) and Agricultural guidance.

These precedent documents are consistent with the recommendations of the Australian Accounting Standards Board (AASB) standards (AASB, 2024) where National Greenhouse and Energy Reporting (NGER) methods are not available, which is the case for livestock-related emissions.

The principles followed, as described by the GHG Protocol, are shown in Table 4.

Table 4 Principles for GHG Accounting Standards

Relevance	Ensure the GHG inventory appropriately reflects the GHG emissions of the company and serves the decision-making needs of users – both internal and external to the company.
Completeness	All attributable and accountable emission sources are included. Non-attributable and non-reported emissions are described.
Consistency	Methods have remained consistent with previous accounts unless scientific changes have occurred in the previous reporting period. Calculation methods or emission boundary changes have been based on new science and documented. Adjustments have been made to previous accounts where appropriate, or differences have been quantified if possible. This has been documented.
Transparency	Clear disclosure and documentation have been maintained. Non-attributable and non-reported sources have been documented and justified.
Accuracy	Input data are verifiable. Calculations are verifiable. Uncertainty has been noted where this can be quantified.

3.1.2. Inventory development

GHG inventory development followed the process outlined in Figure 3, adapted from the GHG Protocol.

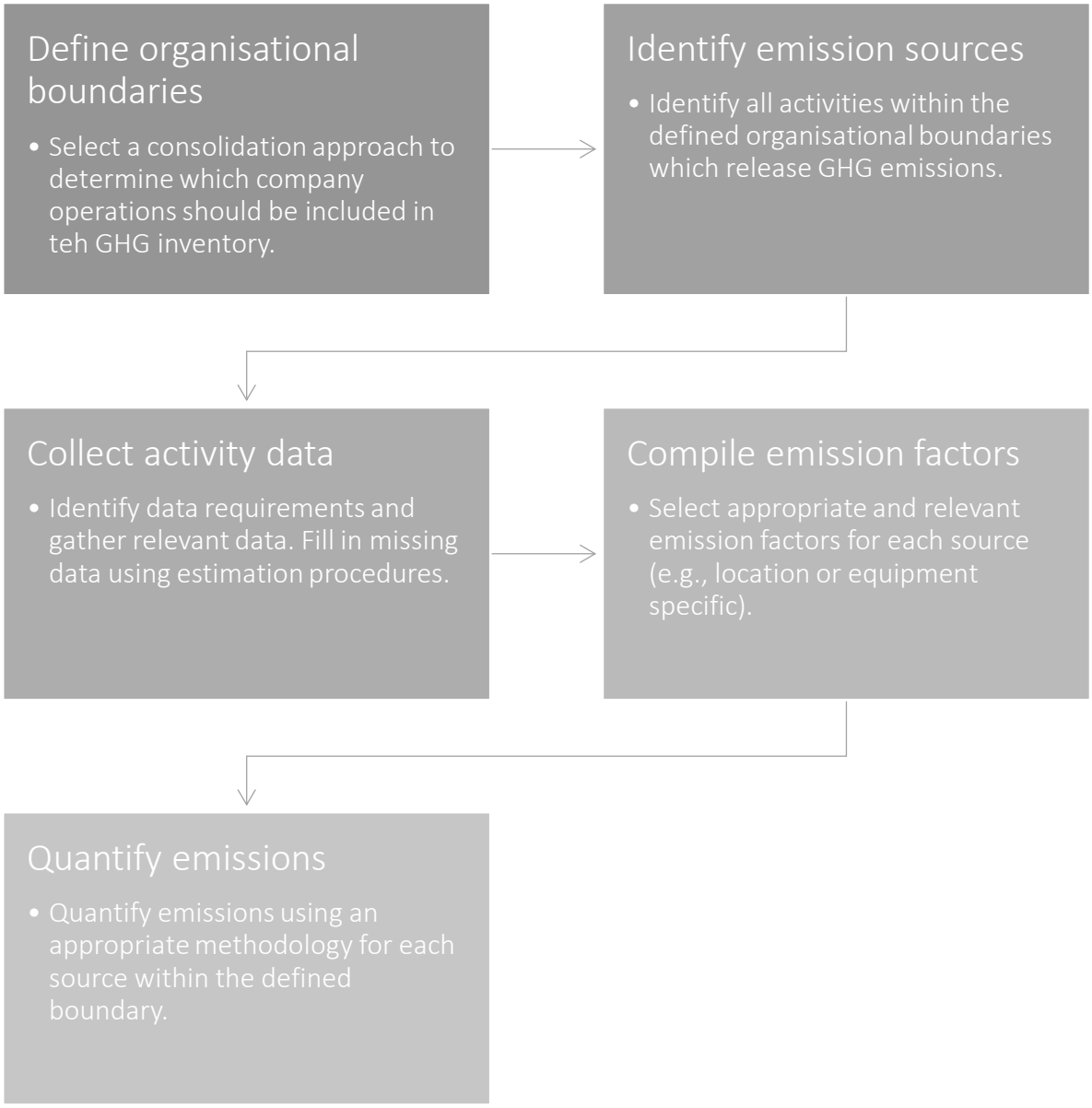

Figure 3. GHG Inventory Development Process

3.1.3. Emission boundary

The enterprise carbon account was completed covering emissions arising directly from within the enterprise boundary covering scope 1 and 2 emission sources during the assessment period.

For the enterprise carbon account, emissions were disaggregated into scope 1, 2 and 3 sources according to the GHG Protocol (Ranganathan et al., 2004). These emission sources are described as follows:

1. Scope 1: "Direct GHG emissions occur from sources owned or controlled by the company."
2. Scope 2: "Accounts for GHG emissions from the generation of purchased electricity consumed by the company."
3. Scope 3: "Are a consequence of the activities of the company but occur from sources not owned or controlled by the company. Some examples of Scope 3 activities are extraction and production of purchased materials; transportation of purchased fuels; and use of sold products and services." These can be further broken down into two sources:
   a. Upstream emissions: from pre-farm sources such as the production of purchased grain, manufacturing of chemicals, purchased livestock emissions and the burning of fossil fuels, including the extraction, production and transport of fuel and electricity. These sources were included in the present analysis.
   b. Downstream emissions: are post-farm emissions associated with the processing of cattle, including emissions from transportation, meat processing and distribution. These sources were included in the present analysis.

A general description on the primary production supply chain is provided in Figure 4. Because this study was completed in collaboration with the red meat industry, only the red meat supply chain was covered by the study. Small additional emission sources exist through pig and poultry supply chains supplying brands marketed by the company.

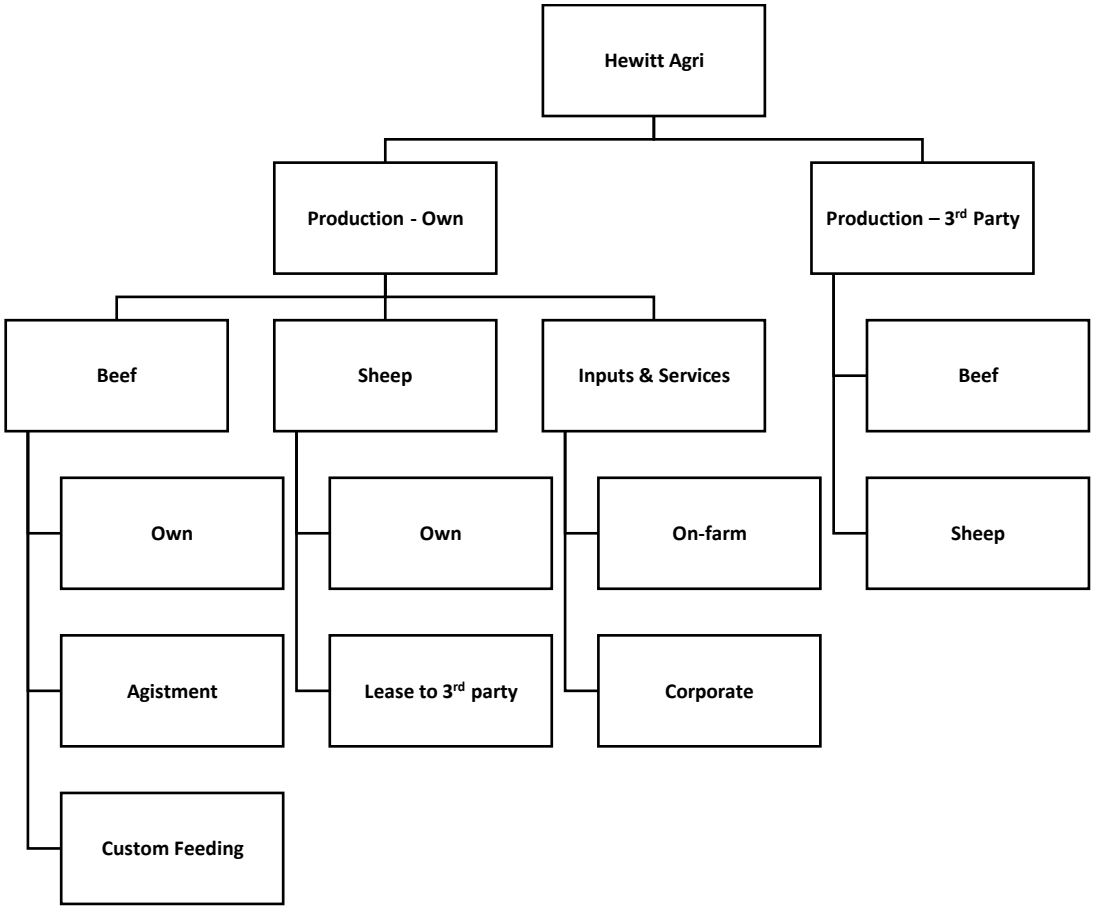

Figure 4. Hewitt Agri – Red meat supply chain

3.1.4. Inventory data

Table 5. Cattle herd inventory for 2022, derived from livestock records

Inventory	Steers	Females	Bulls
Breeder number		45,369	2,536
Young Livestock	41,874	46,214	
Natural increase	20,233	20,253	
Weaning rate		89%	
Mean weight (kg)	301	335	762

Table *6*. Cattle herd inventory for 2023, derived from livestock records

Inventory	Steers	Females	Bulls
Breeder number		46,309	1,999
Young Livestock	44,083	39,959	
Natural increase	16,208	16,208	
Weaning rate		73%	
Mean weight (kg)	327	373	760

Table 7. Sheep flock inventory for 2022, derived from livestock records

Inventory	Rams	Maiden ewes	Breeding ewes	Lambs
Head (opening)	841	5,588	32,768	1,8240
Head (average number over 365 days)	841	5,558	30,911	23,928
Days on farm (DOF) (days)	365	365	365	166
Natural increase				39,827
Weaning rate			122%	
Mean weight (kg)	90	41	64	38

Table 8. Sheep flock inventory for 2023, derived from livestock records

Inventory	Rams	Maiden ewes	Breeding ewes	Lambs
Head (opening)	1,265	5,181	32,314	22,705
Head (average number over 365 days)	1,265	5,138	32,738	29,486
Days on farm (DOF) (days)	365	365	365	162
Natural increase				45,033
Weaning rate			139%	
Mean weight (kg)	90	45	74	30

3.1.5. Scope 1 and 2 emission calculation methods

Climate change impacts were modelled as the amount of GHGs throughout the supply chain. Carbon account methods followed the emission estimation approaches, i) Australian National GHG Inventory, ii) the Red Meat Minimum Standards for Carbon Accounting, and iii) the GHG Protocol Ag Sector Guidance.

Emissions were converted to carbon dioxide equivalent units (CO_2-e) using 100-year global warming potentials (GWP_{100}) of 28 for methane (CH_4) and 265 for nitrous oxide (N_2O) (IPCC, 2015).

3.1.5.1. Scope 1 emissions

Scope 1 emission sources included livestock related emissions, including enteric methane, manure methane and manure nitrous oxide. All emissions were modelled from enterprise-specific activity data, and methods detailed in the Australian National Inventory Report (NIR) (Commonwealth of Australia, 2021b).

Records of purchased inputs, energy use and average transport distances were provided by Hewitt Cattle. Energy use associated with the properties, including homesteads and workshops, was included using records of purchased electricity. Emissions from diesel, petrol and aviation gas were included based on records maintained by Hewitt Cattle. Scope 1 and 2 fuel and electricity emissions were calculated from methods in the National Greenhouse Accounts Factors (Commonwealth of Australia, 2021a). The carbon modelling was conducted using the IA facility calculator.

Enteric methane was determined from a detailed inventory of livestock data, which were used to estimate feed intake and enteric emissions using the equations published in the NIR (Commonwealth of Australia, 2021b). Correctly determining emissions is reliant on a quality inventory of livestock numbers, head days, growth rates and physiological status. Data were supplied from inventories maintained by the business across the breeding, backgrounding and finishing enterprises.

Manure emissions were determined from livestock inventories, which was used to estimate excreted manure nitrogen (N) and volatile solids (VS) in grazing cattle and sheep, and subsequently nitrous oxide and methane, using the equations published in the NIR (Commonwealth of Australia, 2021b). Because of the predominance of bore water supply and subsequent small number of farm dams, methane emissions associated with manure in farm dams were not included.

3.1.5.2. Scope 2 emissions

Scope 2 emissions were determined from records of grid electricity use at all facilities multiplied by NGA factors (Commonwealth of Australia, 2023).

3.1.6. Scope 1 Land use and direct land use change

Carbon stock changes in vegetation and soils may result in emissions or removals. Typically, these are measured from the stock change in carbon in these sources over a selected period.

A positive carbon stock change (representing more carbon in trees or soil) results in a negative emission flow, i.e., removal of CO_2 from the atmosphere and a negative value (deduction) on the carbon account. To help differentiate carbon stocks and emission flows, we report carbon stocks in tonnes of carbon (t C) and emissions in t CO_2-e. A 1-tonne increase (+) in carbon storage in trees or soil results in an emission flow of (-) 3.67 t CO_2-e in the atmosphere and visa-versa.

Two different land-states are considered. Impacts from Land Use (LU), which represents land that remains in the same land use category from year to year during the assessment period (i.e. business

as usual), and land transformation or Land Use Change (LUC), which represents conversion of land from one land use category to another, within the assessment period.

Land Use impacts arise where significant degradation or significant regeneration of land has occurred. Annual fluctuations can occur in response to biogenic processes such as drought or above average rainfall, which are typically outside the emission boundary and are not attributed to the business or production system.

Land management practices can impact carbon stocks and these are assessable as part of Land Use accounting. Processes such as significant overgrazing can negatively impact soil and vegetation carbon stocks. Regenerative grazing practices with sustainable stocking rates, better ground cover, rotational grazing and management of feral animals can have a positive impact on carbon stocks.

Under well managed land, it is common to observe no change in carbon stocks and no emissions when averaged over the mid-term when the impact of biogenic, seasonal effects has been removed. As a consequence, Australian guidance considers a “no change” assumption valid for well managed grazing land (DCCEEW, 2024; Eckard, 2024). This assumption was applied for all land that had been managed within the same land class within the project boundary, with the exception noted below.

Land Use Change here described as “direct” land use change using the terminology of GHG Protocol, occurs as a result of converting land from one land use category to another, which typically impacts carbon stocks. Major potential impacts arise from changes between grassland and forest, and grassland and cropland, impacting vegetation carbon pools and soil carbon pools.

Some Land Use Change events have a long-term impact on carbon levels, which blurs the line between Land Use impacts and Land Use Change impacts. For example, conversion of land from grassland to cropping can result in ongoing soil carbon loss over >20 years (Dalal & Mayer 1986). Similarly in reverse, conversion of crop to grassland may result in soil carbon increases over decades. The same situation can occur with forest to grassland and the reverse.

Emissions and removals from LU and dLUC sources remain less certain and subject to unclear guidelines. Noting the high level of uncertainty, analysis is ongoing to improve certainty and provide results that can be reported publicly.

3.1.7. Scope 3 emissions

Scope 3 emissions were assessed covering all major categories according to the AASB standards, which followed the 15 GHG Protocol categories for scope 3 analysis. Scope 3 impacts were determined using mass and product type and specific scope 3 modelling or emission factors for sources that contributed a large proportion of the impacts and for sources that were material for the product carbon footprint calculations and were a direct component in the final product mass (see Section 3.1.7.1). For other sources, value was used combined with EEIO factors. Expenses were provided by station with groupings made to allocate each expense to the suitable category. Calculations were completed separately for Hewitt Agribusiness and Hewitt Foods so that scope 3 emissions could be split out for these sources.

3.1.7.1. Scope 3 emissions from livestock: Third party suppliers

A portion of cattle and sheep processed by Hewitt are sourced from third-party producers. Livestock may be directly purchased from producers immediately prior to meat processing, may be purchased as backgrounding or feeder animals for finishing, or may be purchased as boxed product post processing.

Key suppliers were engaged to supply inventory data, which was kept confidential. This was used to generate carbon footprints for key suppliers and to determine the average impacts from purchased livestock through use of comprehensive processing data for all livestock purchased from third parties. Impacts were modelled using the Integrity Ag Verified Carbon Footprint model. The methods supporting this model have been published previously (Wiedemann et al. 2016a, Wiedemann et al. 2016b, Wiedemann et al. 2015, Wiedemann et al. 2023).

3.2. Natural capital and biodiversity baseline

Bush Heritage led development of a baseline profile for limited aspects of natural capital accounting, focussed on biodiversity. This work focussed on a selection of Hewitt's Portfolio as part of the project, covering around 2 million ha of diverse properties assessed across NT, QLD and NSW.

3.2.1. Detailed Biodiversity Asset Baselining

The appropriate measurement and management of Natural Capital can be a broad and complex area. Bush Heritage follows a strategic framework which commences with characterisation, building up to measurement and refinement. This process is outlined within Figure 5.

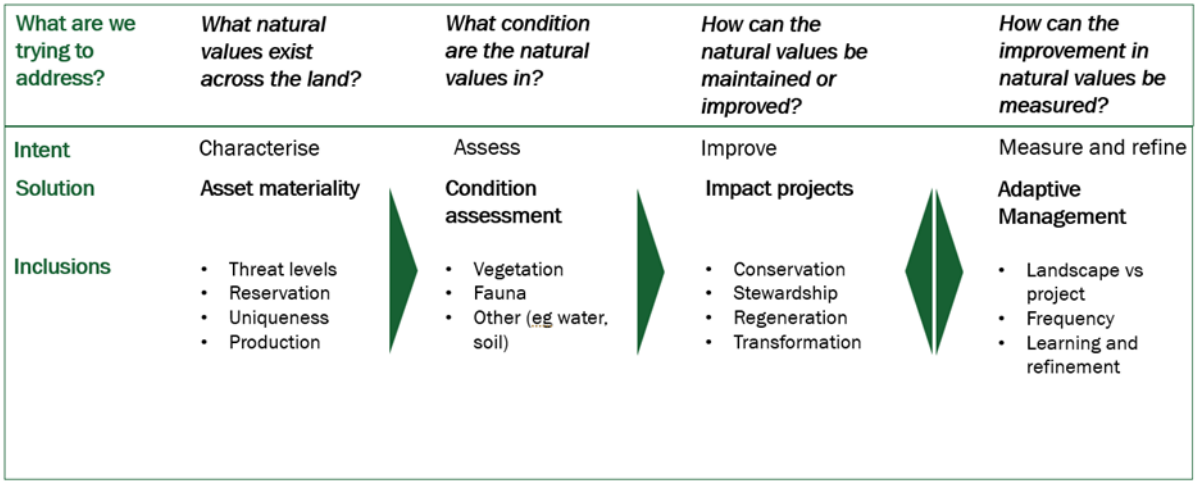

Figure 5. Bush Heritage Australia strategic framework for measuring and managing natural capital

Figure 6 provides an outline of how this framework was applied to the Hewitt project objectives.

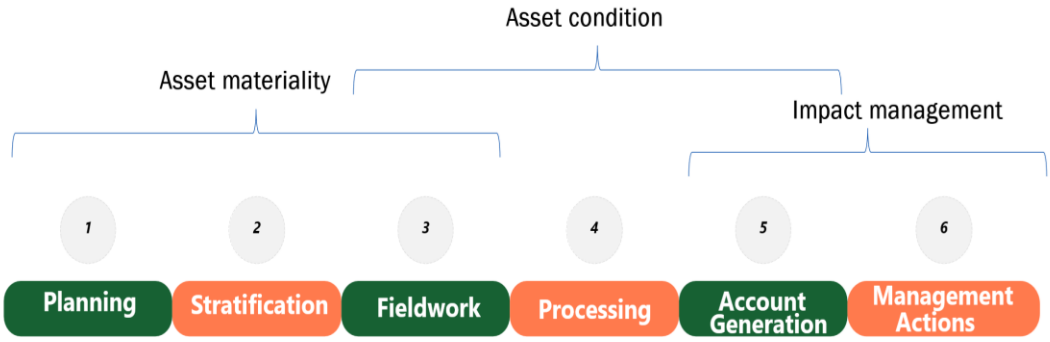

Figure 6. Strategic framework applied to the Hewitt project

Bush Heritage utilised the Integrated Vegetation Condition Method (NV-10), an accredited Method under the Accounting for Nature (AfN) Framework developed by Bush Heritage. NV-10 aims to detect native vegetation condition at a given point in time, as well as long term change.

Method NV-10 is uniquely suited to monitoring rangelands. The Method works across entire properties, ideally suited to larger properties between 2,000- 2,000,000 ha. It is applicable to a range of Ecosystem Functional Groups including Tropical-subtropical forests, Temperate-boreal forests and woodlands, Shrublands and shrubby woodlands, Savannas and grasslands, Deserts and semi-deserts, Polaralpine, and Intensive land-use systems under the IUCN Global Ecosystem Typology. However, the Method is less suitable in systems comprising dense canopy cover due to limitations of high-resolution remote sensing being able to accurately survey shrub and ground layer indicators.

The AfN Framework is a leading environmental accounting standard that uses the science of reference condition benchmarking to create a common unit of measure for building sets of biophysical accounts that describe the condition of any environmental asset, in this case, native vegetation. This common measure is referred to as an Econd, and is an index between 0 and 100, where 100 describes an environmental asset in an undegraded state.

Experience demonstrates that focusing on vegetation condition is a consistent and comparable measurement of biodiversity and is the most relevant and robust across Australian landscapes.

The key steps required to execute NV-10 are summarised as follows:

1. Stratification, which is the grouping of similar vegetation groups for the purpose of assessment site assignment.
2. Field assessment of vegetation type and condition.
3. Data interrogation comparing observed results to reference condition benchmarks.
4. Environmental Account compilation and management actions.

Stations within the project scope were assessed and aggregated into the following four major Environmental Accounts:

- New South Wales.
- Queensland.

- Ambalindum and Numery Aggregation.
- Narwietooma Aggregation.

The use of NV-10 was broadened in this project to include a number of strategic variation items designed to leverage core focal works. This included the execution of an asset materiality assessment (tiering of assets), the development of reference condition data where inaccurate or not otherwise available and select targeted fauna insights.

Once field indicators had been assessed, the collected data was interrogated to enable Environmental Account generation and ultimately the calculation of an Econd score.

The Econd was calculated as the product of the Quantity (extent) x the Quality (composition and configuration). As the condition and type of native vegetation typically varies over an area, the account must adequately express these differences. In the simplest example, if an area contained 50% intact native grassland, and 50% sown pastures (assumed to have an Econd of 0), the highest Econd the Account can get is 50.

The key drivers behind an Econd under NV-10 are:

- Landscape context: 25% contribution.
- Indicator Condition Score: 75% contribution.
- Area weighting.

The method prescribes instructions for calculating Econd indices for each Assessment unit then aggregates these into an Econd for each Vegetation Sub-asset before finally aggregating these into the overall Econd for the Account.

Immediately post data collection, drone images were pre-processed involving the ‘stitching’ of individual drone images to create a high-resolution map of the plot. The images were then annotated to generate training data, which was used to train classification models.

Validating accuracy was another key requirement of the method. Validation required that points were randomly distributed throughout drone imagery plots, before an observed class is assigned to each point. The assigned class was compared to the modelled class, and the rate at which observed and modelled classes match provides the model accuracy. Figure 7 demonstrates this. Training data was continued until sufficient accuracy was reached (>75%) in line with the method requirements.

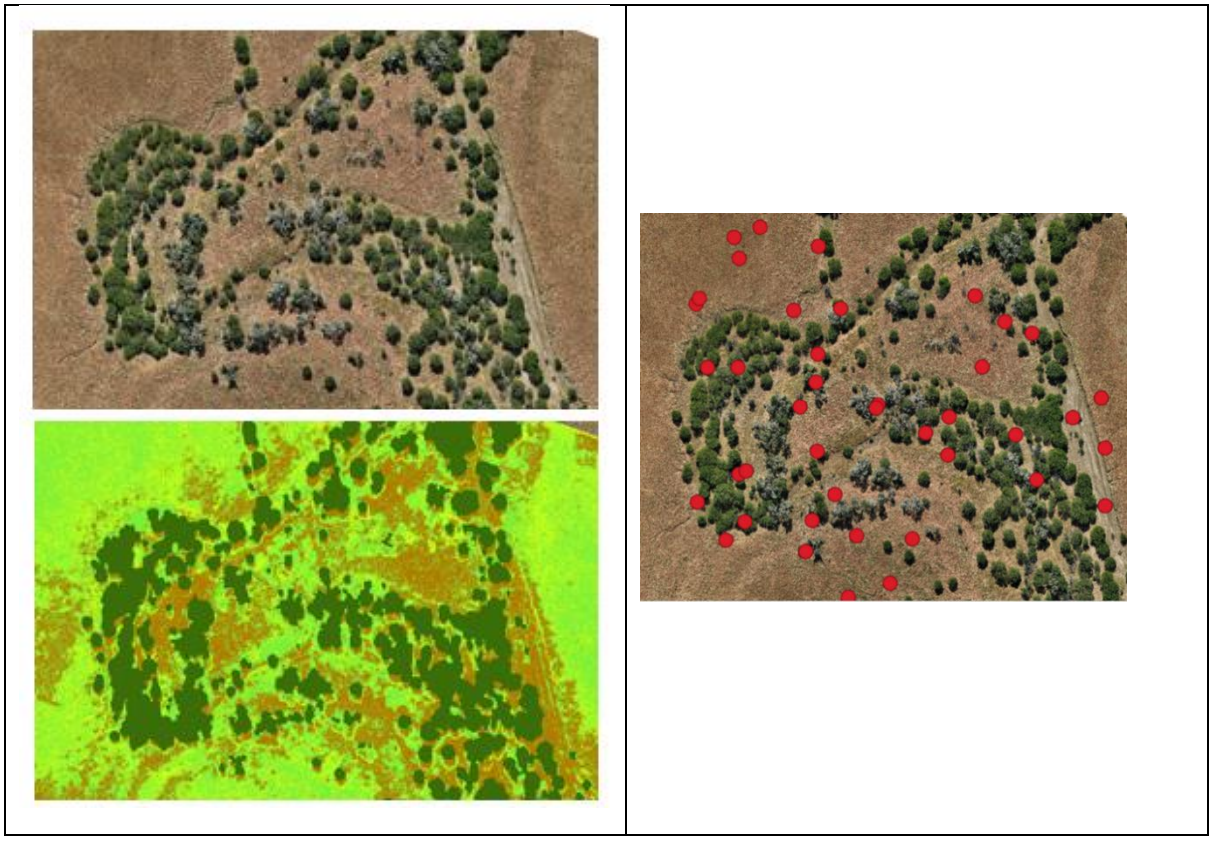

Figure 7. Accuracy assessment example utilising the Random Forest Model

Indicator Condition Scores (ICS) were based on the difference between observed indicator values, and reference benchmarks – with a formula available for each indicator. Each indicator within the Configuration and Composition Indicator Classes is converted to an index ranging from 0-100. The Extent Indicator Class values were not used in the same way as other indicator classes, however, was utilised when aggregating the Econd using area weighted averages.

Stratification

Utilising a combination of state-based pre-1750 maps, geology, soil and Land System maps as well as an understanding of general land condition (eg. Utilising a combination of state-based pre-1750 maps, geology, soil and Land System maps, as well as an understanding of general land condition (eg. land use history), each station was stratified into similar vegetation groups with sufficient representation of broad vegetation and threatened communities. Representative sites within Cadastral property boundaries were allocated in line with NV-10 requirements.

Figure 8 provides an example of a stratified map of Hewitt owned “Coolreagh Station”, complete with designated assessment sites. Figure 9 summarises the total area and asset types across the properties in scope.

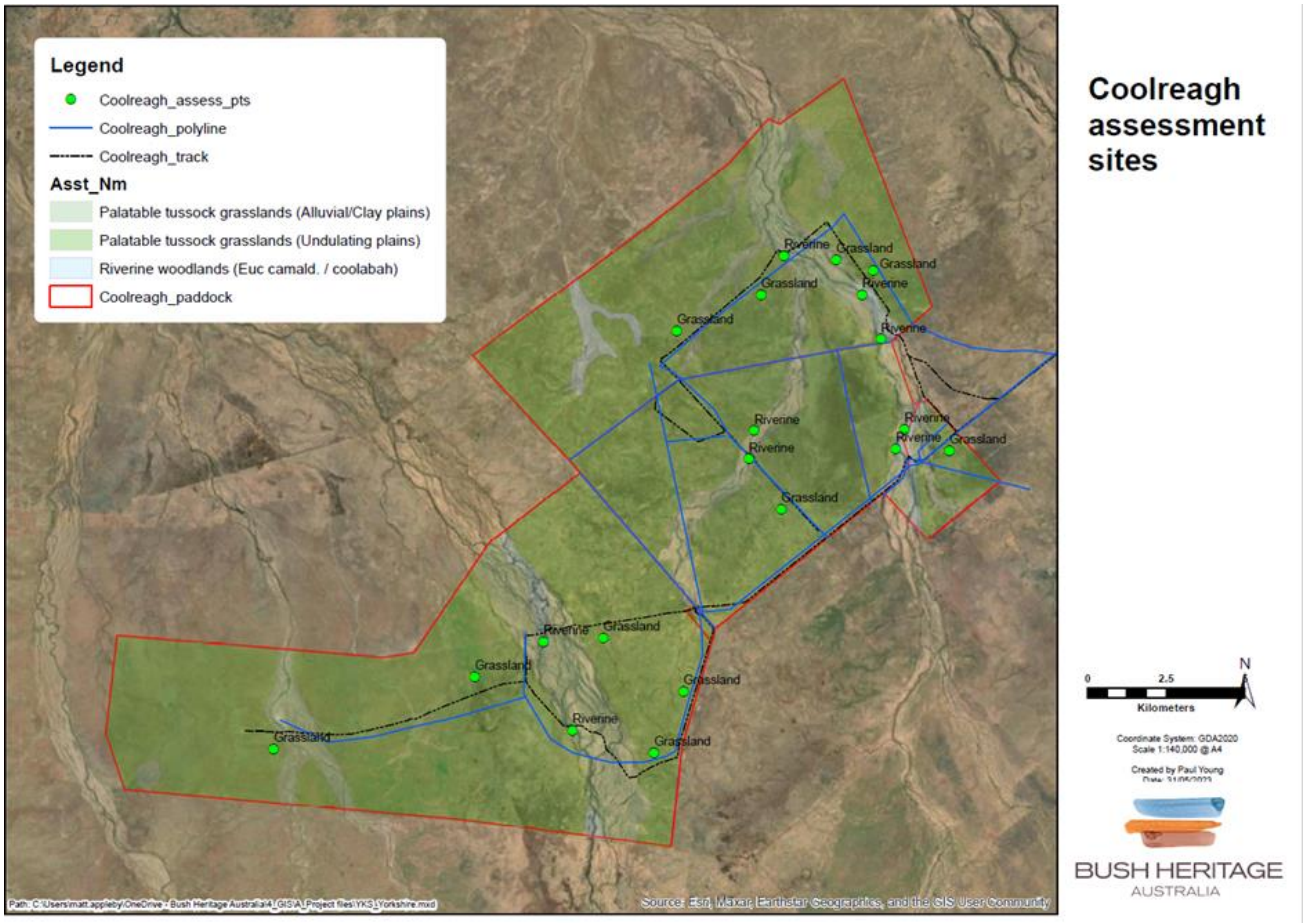

Figure 8. Coolreagh Station stratification

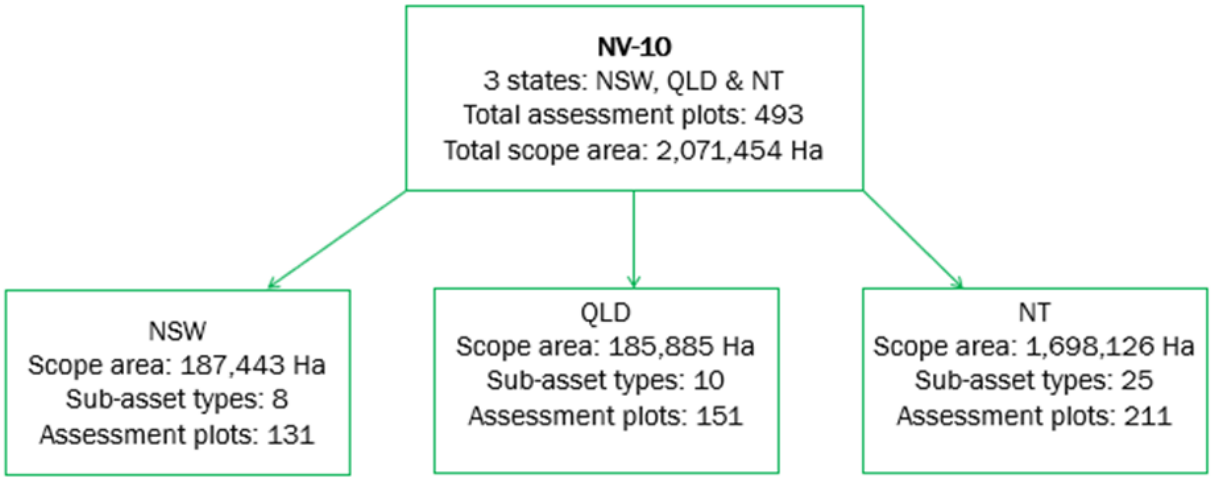

Figure 9. Stratification summary of properties in scope

3.2.1.1. Indicators and Reference Benchmarks

An important part of accurately assessing the condition of native vegetation under NV-10 is the use of established indicators to describe native vegetation condition. The indicators for native vegetation must represent the following three classes:

- Vegetation extent: the area and proportion of sub-assets in the landscape.
- Configuration: how the sub-assets are distributed across the landscape.
- Composition: such as structure and species richness of sub-assets.

The AfN standard refers to the reference benchmark as the 'undegraded' state of each native vegetation type, representing the pre-1750 conditions. NV-10 allows for the utilisation of different benchmark sources including local, published, modelled or expert elicitation.

For the Queensland properties, state-based reference benchmarks were utilised. For large parts of NSW and the NT, the state-based maps were either inaccurate or incomplete. As a result, targeted input from state-based herbaria, and expert elicitation based on the expertise of local botanists was utilised to establish reference benchmarks for many properties.

Outcomes of the NCA are summarised in the results section.

3.2.2. Natural Capital Assessment supply chain pilot

The detailed benchmarking of natural capital and biodiversity was valuable as a long-term record of performance for Hewitt owned properties, but scaling this assessment for the supply chain was constrained by the cost of implementation. Limitations also exist with respect to interpretation of the results by supply chain partners, including those in overseas markets not familiar with Australian frameworks such as AfN. Further options were explored to create a scalable method of mapping properties and conveying simple but important metrics regarding management of natural capital assets. This was undertaken using the following broad steps:

1. Whole assessment was based on the Taskforce for Nature-related Financial Disclosures (TNFD) "LEAP" reporting process. This approach was chosen to consolidate, expand, and synthesize Hewitt's natural capital information into a single, repeatable natural capital reporting framework.
2. The assessment targeted material assets important to or impacted by Hewitt, evaluated by either a panel of experts or through repeatable spatial assessments. These assets were also assessed from a risk perspective, and opportunities for management and monetization were explored.
3. Nine natural capital assets relevant to livestock production systems were measured specifically for each property, with the remaining assets reviewed by a panel of experts for the broader region. These assets included forage/soil condition, forest cover extent, forest-based pasture benefit, forest connectivity, general habitat condition, riparian forest extent, significant species habitat condition, significant species on property, and vegetation-based carbon yields.
4. The results were used to create an asset register that includes an impact/dependency assessment as well as a risk/opportunity assessment.
5. The assessment was conducted using a combination of desktop spatial assessments and expert evaluations, with the results consolidated into individual reports for each supplier (which were aggregated for supply to Hewitt) and the Hewitt portfolio properties.

3.2.3. Deforestation

The presence of deforestation within the supply chain is a key topic across primary production enterprises. The definition of deforestation is varied across stakeholders, including customers, markets, service providers, accreditation systems, and governing bodies.

As part of the current study a deforestation screening assessment was done to investigate the range of market based requirements and different definitions that need to be considered.

3.3. Insetting and offsetting opportunity

The Hewitt portfolio was assessed for potential insetting and offsetting opportunities. This included desktop screening across the 14 properties, of which six were progressed to project feasibility assessments. The six project feasibility assessments included two in each of the areas of native vegetation regeneration, soils, and environmental plantings.

Initially, feasibilities were completed using ACCU Scheme methods which provided the highest degree of clarity and certainty in the methods for assessing change and quantifying improvements over time, through generation of registered carbon credits. However, the principal objective for Hewitt was to demonstrate and verify lower net emissions of the enterprise and products sold, and generating a carbon credit may not be necessary to achieve this outcome. Further, limitations exist with credit generation because of compliance costs and regulatory restrictions. Because of these limitations, a review was also conducted of opportunities to claim 'insetting'; i.e. removals within the supply chain, including through use of verification systems that did not require a carbon credit. Key insights are included in the discussion. The following sections outline specifics of the approach taken to assessing offsetting and insetting opportunities.

To date there is a lack of validated, peer-reviewed insetting guidelines available for implementation in the Australian context that don't require creating a carbon credit. Currently, there is a draft tree planting method available for the Climate Active program, but this has not been finalised or endorsed for use by Climate Active or the Federal Government. To address this gap, a HIR-type insetting approach was investigated, which aimed at GHG Protocol compliance using local detection and accounting methods. Key criteria within the GHG Protocol framework were addressed, including removals guidance.

3.3.1. Native Vegetation

All properties were screened to assess regeneration and potential for registration under the ACCU Scheme Human Induced Regeneration (HIR) method (method now closed). Properties were mapped to provide vegetation area estimates over a 20-year timeframe using the National Forest and Sparse Woody Vegetation Dataset (Australian Government Department of Climate Change Energy the Environment and Water, 2022). These were reported in the following standard categories matching forest definitions in Australia:

- Total Forest Area (greater than 20 % canopy cover, >2m in vegetation height and >0.2ha minimum area size).
- Sparse Woody Area (between 5-19 % canopy cover, >2m in vegetation height and >0.2ha minimum area size).

- Non-Woody Area (less than 5 % canopy cover, >2m in vegetation height and >0.2ha minimum area size).

It should be noted that the estimated area under total forest, sparse woody vegetation and non-woody vegetation has not been verified and may include errors inherent to the vegetation mapping data used.

Based on the observations from these estimates, and discussion with Hewitt, two properties were selected for feasibility screening. The selected properties were Narwietooma (NT), and Packsaddle (NSW).

The assessments explored the feasibility of transitioning Forest Potential areas into Forest Cover through strategic management activities eligible under the Emissions Reduction Fund's Human induced regeneration (HIR) method, which was current at the time of assessment. This provided carbon sequestration estimates from applying the Method to the Study Area. By combining desktop analysis, remote sensing, and on-ground surveys, this assessment aimed to:

- Inform a project design which considers the dual objectives of carbon sequestration and primary production through additional best-practice management activities which will support the co-existence of grazing and carbon sequestration.
- Evaluate the technical feasibility of a HIR project within the Study Area.
- Estimate hypothetical returns from sequestered carbon through Deep Learning modelling.

The methods used in this assessment was consistent with the Human-Induced Regeneration, and establishes:

- Exclusion/ineligible areas: Areas within the Project Area that are not subject to the project mechanism nor HIR activities.
- Pre-existing/baseline Forest Cover: Any area during a 10-year baseline period that achieved Forest Cover (i.e., native woody vegetation above 2m in height and having more than 20% canopy cover) which is required to be excluded from the assessment.
- Forest Potential: Areas demonstrating regeneration (below 20% canopy cover and with minimum stem counts as per the Method) that are likely to become a Forest (native woody vegetation above 2m in height and having more than 20% canopy cover).
- Carbon Estimation Areas (CEA): Non-contiguous areas stratified from Forest Potential areas, with consideration given to the approximate age class and species composition of existing vegetation communities. This is the area that carbon sequestration is derived from.

An assessment was made of the relative confidence that can be placed in CEAs' realistic ability to achieve and sustain Forest Cover within the required timeframe (i.e., within 16 years from the project's registration). The amount of area available as Forest Potential was refined through a multi-staged analysis. Two Potential CEAs (high confidence and low confidence) were created on request of the Clean Energy Regulator (CER) by defining and refining areas of modelled Forest Potential against certain ecological requirements. The high confidence CEA is a subset of the low confidence CEA. As the name implies, the high confidence CEA was evaluated to have a higher chance of achieving and sustaining Forest Cover.

Sequestration is possible when land with the Potential to support Forest is regenerated into a Forested state. This is the premise of the HIR method, where Forest is defined as native woody vegetation with

more than 20% canopy cover and exceeding 2 metres in height. As the Forest grows, it follows a sequestration growth curve which is modelled using the Australian Government's full carbon accounting model, FullCAM. Carbon sequestration is achieved and maintained so long as the Forest remains intact. As such, permanence periods (of 25 and 100 years) are associated with regeneration methods.

An important factor in assessing the feasibility of regeneration is technical feasibility: whether the land can realistically be expected to achieve Forest Cover. A range of factors play a role in informing this outcome, including historical Forest Cover, remnant vegetation, landscape ecology, vegetation community composition and structure, age classes, and an understanding of the extent to which human activities may be suppressing Forest Cover. If land with Forest Potential has a propensity towards Forest, in addition to evidence that mature versions of the same vegetation communities in similar environmental conditions can sustain Forest Cover, then achieving sequestration through a regeneration method is likely to be technically feasible.

The second factor in determining the feasibility of a regeneration method is whether the land, proponent, and proposed project meet eligibility requirements. While the exact requirements vary between regenerative methods, they typically fall into one of three categories: i) evidence of regeneration potential, ii) newness and additionality, and iii) legal right. The first involves proving that the project is technically feasible and may include evidence of suppression or plans to induce and protect Forest growth. The second refers to the concept that any abatement under the project must be additional to a business-as-usual scenario. This includes reference to a baseline period through which certain activities or land cover types may be excluded. The third category may involve documentation to demonstrate that the proponent has acquired legal right and the necessary consents to participate. Although eligibility requirements are outside the scope of this feasibility assessment, they were assessed in detail during the registration process, which led to a successful registration.

Outcomes of the HIR feasibilities are summarised in the results section.

3.3.2. Soil

All properties were mapped to assess the 0-5, 5-15, and 15-30 cm layers from the Soil Organic Carbon predictions from CSIRO (Wadoux et al., 2022a, 2022b), which were averaged and weighted proportionally to their respective depth range. Based on the observations from these estimates, and discussion with Hewitt, two properties were selected for feasibility screening. The selected properties were Pegunny (QLD), and Tubbo (NSW).

The feasibility assessment was conducted at a desktop level using the best available datasets on soil organic carbon and the environmental variables associated with soil organic carbon.

Modelling of soil organic carbon sequestration is consistent with the Carbon Farming Initiative's Estimation of Soil Organic Carbon Sequestration Using Measurement and Models Methodology Determination 2021 (Australian Government, 2021) to provide an estimate of potential returns from an ACCU Scheme soil carbon sequestration project on the property. This assessment establishes:

- Site Context including the study area, adjacent soil carbon projects, identification of soil types based on Australian soil classification mapping data, clay content based on modelled and site

data (if available), and historical management practices on the Study Area during the baseline period of the project.

- Soil Organic Carbon (SOC) Potential including modelling the Study Area using best available CSIRO SOC mapping, and an analysis on the potential upper limit of SOC over the Study Area.
- Project Scenarios including assessing relevant future management practices to build SOC in carbon estimation areas.
- Potential Carbon Estimation Areas within the Study Area, by considering historical land use and the soil organic carbon sequestration potential of the land by establishing the selected project activities.
- Carbon Sequestration Estimates from each CEA including considering management implications and risks.

The assessments were not ground-truthed and therefore are limited by nature. Key factors driving soil carbon project feasibility include the current quantum and variability of SOC over the Study Area, and the potential for change in soil carbon with improved practices. Current soil carbon levels can be difficult to accurately assess in the absence of extensive site-based soil test data. Prior to making project related decisions, more information can be gathered by soil testing and a full feasibility study, to test the assumptions in this analysis and provide a higher degree of certainty.

Outcomes of the soil feasibilities are summarised in the results section.

3.3.2.1. Pegunny Site Context:

Study Area: Pegunny Station is located about 15km west of Moura in Queensland, covering 26,637 ha.

Management History: The site is an aggregation of properties, which have historically been grazing or cropping properties over the past 50 years. At the present time, most of the property is grazing land, with a mixture of native and non-native pastures including buffel and some established Leucaena.

All paddocks were used for grazing cattle during the baseline period. Approximately 4,990 ha were improved by establishing leucaena with row spacing of 8m to 14m and inter-row pastures including buffel, desmanthus, and mixed pasture. Leucaena height varies from 0.5m to 3.5m.

Adjacent Projects: There are 63 registered ACCU Scheme projects within a 150-200km radius of the property, with 49 being soil carbon projects. Most of these projects have not yet been issued any ACCUs as they are still early in the credit generation cycle. Two of the soil carbon projects have been issued ACCUs, averaging 20.4 ACCUs/ha over five years.

Soil Types: About 80% of the soils are Vertosols, 19% are Sodosols, and the remaining 1% are a mix of Dermosols, Kurosols, Kandosols, and Rudosols (see Figure 10). Vertosols have high agricultural potential due to their fertility and water-holding capacity, while Sodosols have low potential due to high salinity levels.

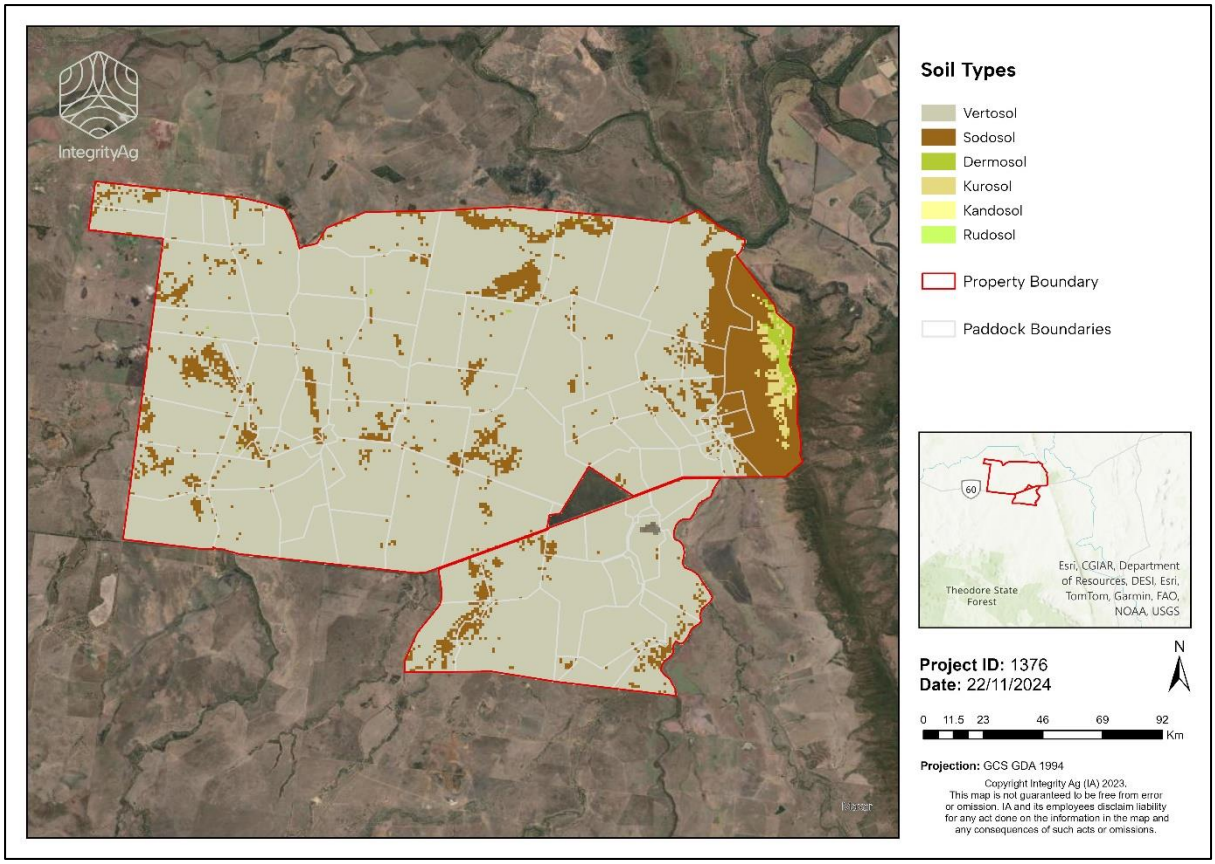

Figure 10. Soil types on the property (Australian Soil Classification data)

Soil Clay Content: Soil carbon storage capacity is typically strongly correlated to soil texture in land that has not been subjected to historical Land Use Change, with heavy-textured clay soils typically storing more carbon than sandy soils. The clay content varies across the property, reflecting changes in soil type (see Figure 11).

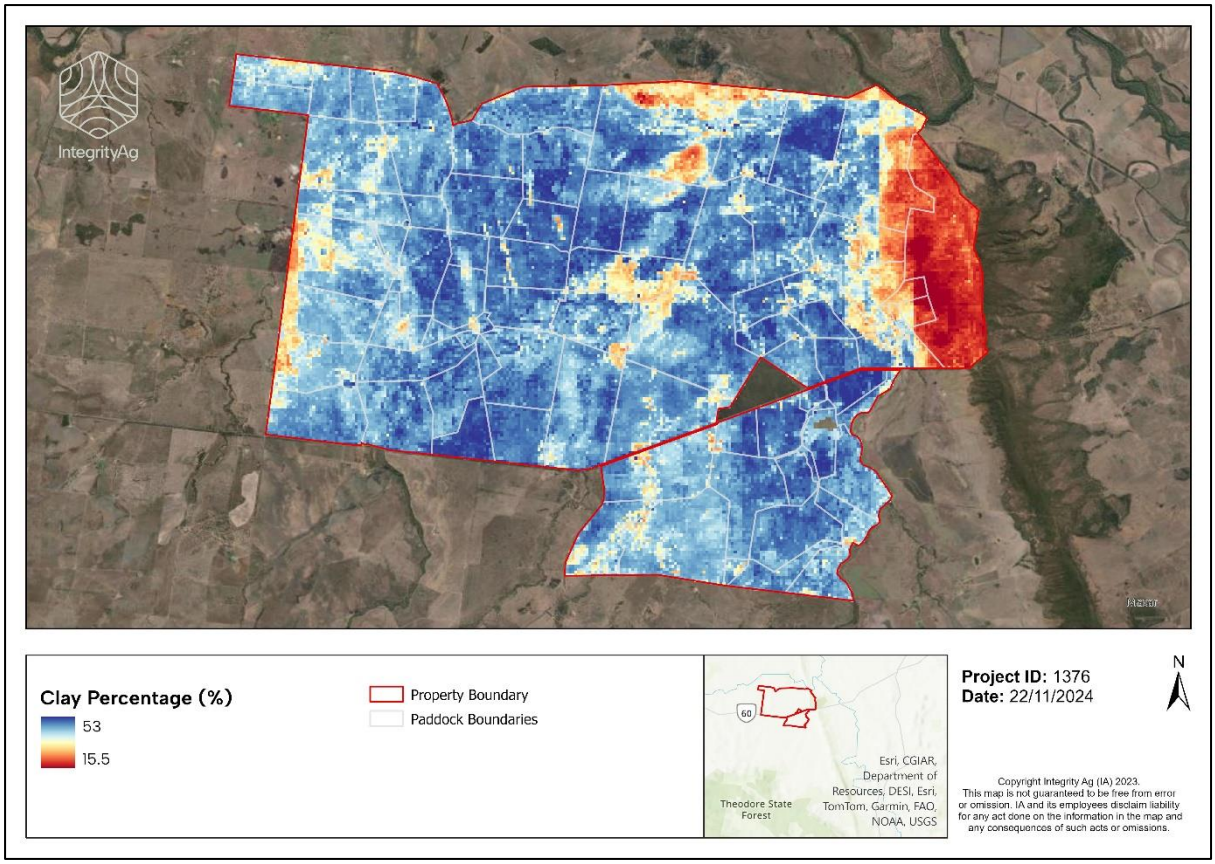

Figure 11. Clay percentage in the top 0-30cm of the soil, using CSIRO data

Soil Carbon: The predicted SOC from CSIRO modelled data for the 0-30cm layer of soil shows higher SOC concentrations in areas that have not been subject to historical land use change; conversion from forest to grassland to cropland (see Figure 12). The distribution of estimated SOC indicates that up to 0.5% SOC has been lost on cleared or cultivated land areas compared to uncleared native vegetation with similar soil types. This data highlights the impact of land-use and management practices on SOC retention and serves as a useful tool for gauging soil carbon storage potential across different soil types.

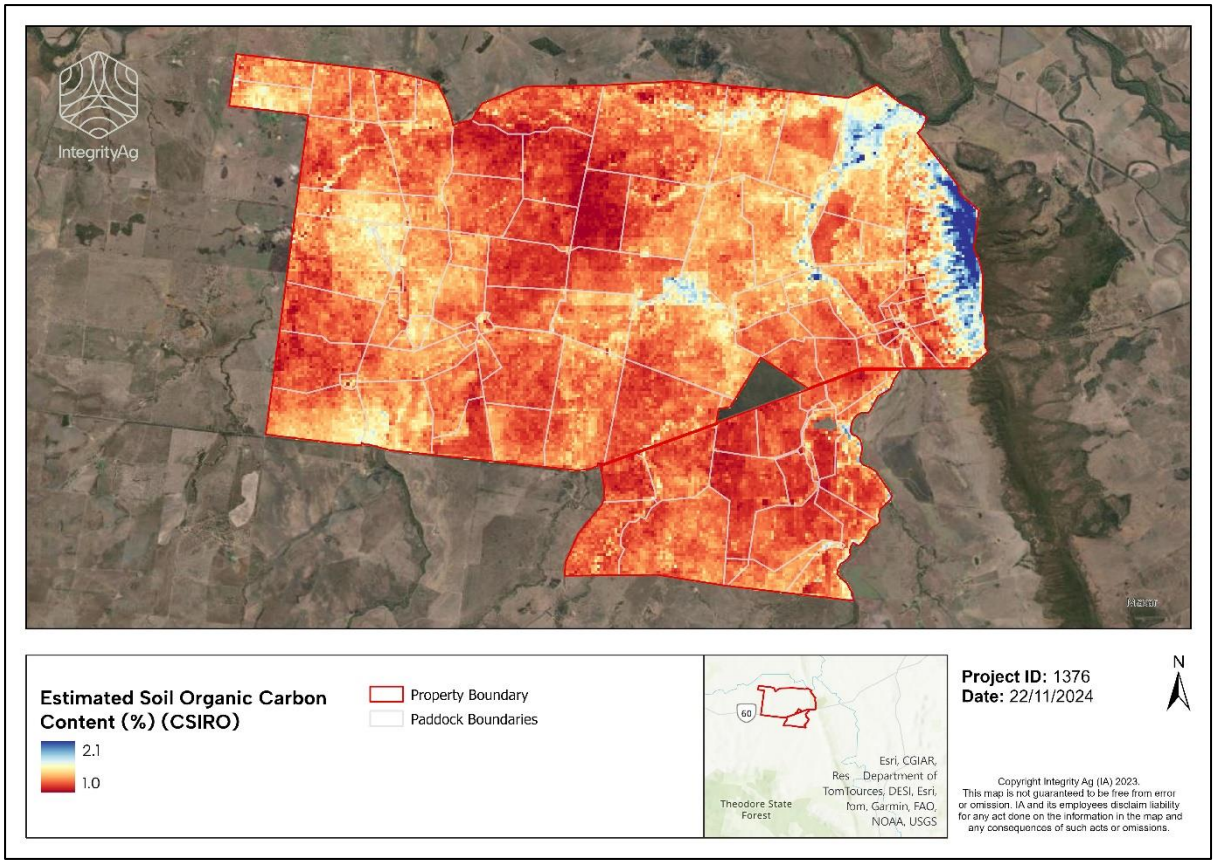

Figure 12. Estimated SOC% in the top 0-30cm of the soil, using CSIRO data

3.3.2.2. Tubbo Site Context

Study Area: Tubbo Station is a cattle farming enterprise located approximately 40km south of Griffith in the Riverina region of South-Western New South Wales. The property covers 16,198 ha and is owned by Dawson Land Investments Company Pty Ltd., which is interested in establishing an ACCU Scheme soil carbon project at the site.

Management History: All paddocks on the property were used for cattle and sheep grazing during the baseline period. Attempts to burn some paddocks to increase desired pasture species like clover were made but did not deliver the desired results. Potential sodicity due to waterlogging has been identified in the southern regions of the property and has not been addressed during the baseline period.

Adjacent Projects: There are 47 registered Australian Carbon Credit Unit (ACCU) Scheme projects within a 150-200km radius of the property, with 31 being soil carbon projects. Most of these projects have not yet been issued any ACCUs as they are still early in the credit generation cycle. Typically, soil carbon credits are issued 5-10 years after registration.

Soil Types: An analysis of the Australian soil classification data showed that about 58.5% of the soils are Chromosols, 41% are Vertosols, and the remaining 0.5% are Tenosols (see Figure 13). Chromosols have a moderate to high agricultural potential and are susceptible to structural decline and acidification, especially under cultivation. Vertosols are cracking clay soils with high fertility and strong water-holding capacity, giving them a high agricultural potential. Significant amounts of rain or irrigation are required on Vertosols before water is available to plants.

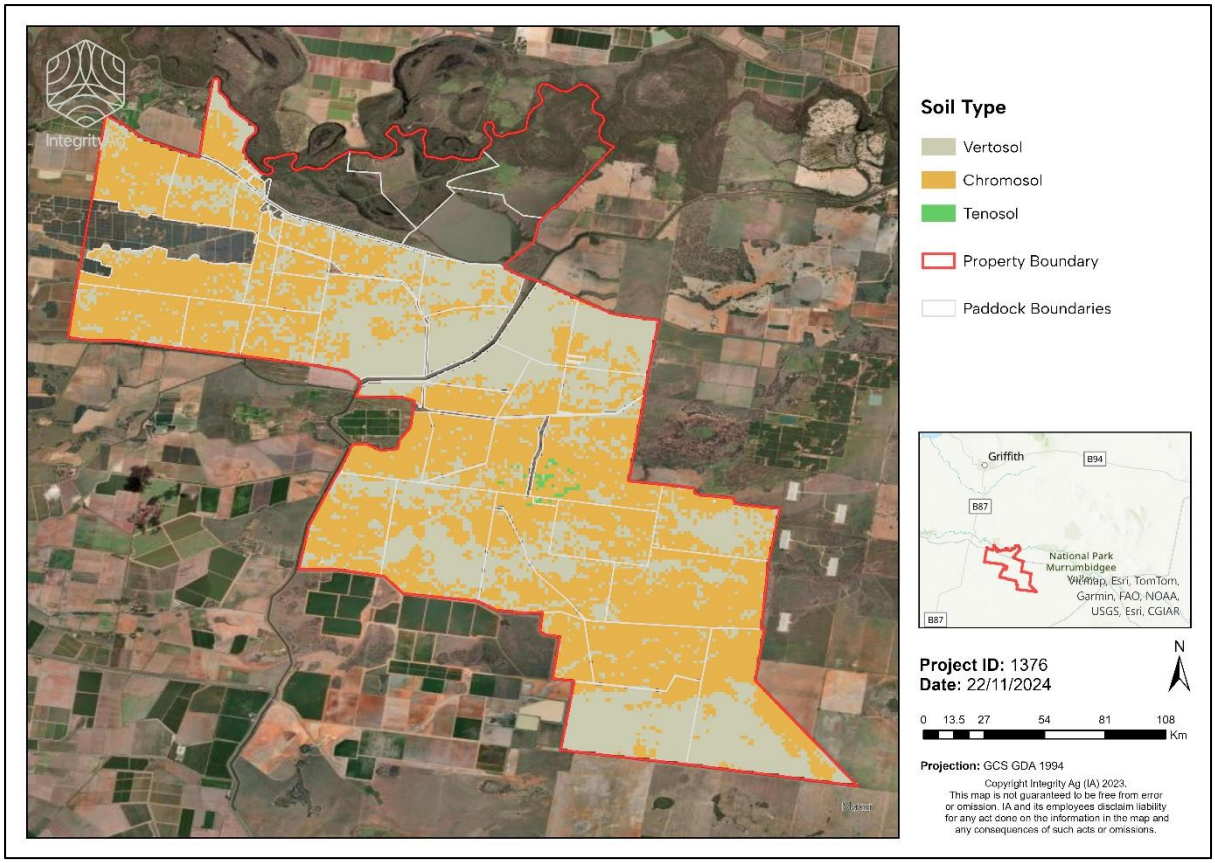

Figure 13. Soil types on the property (Australian Soil Classification data)

Soil Clay Content: Soil carbon storage capacity is strongly correlated to soil texture, with heavy-textured clay soils typically storing more carbon than sandy soils. The varying clay content across the property reflects changes in soil type (see Figure 14).

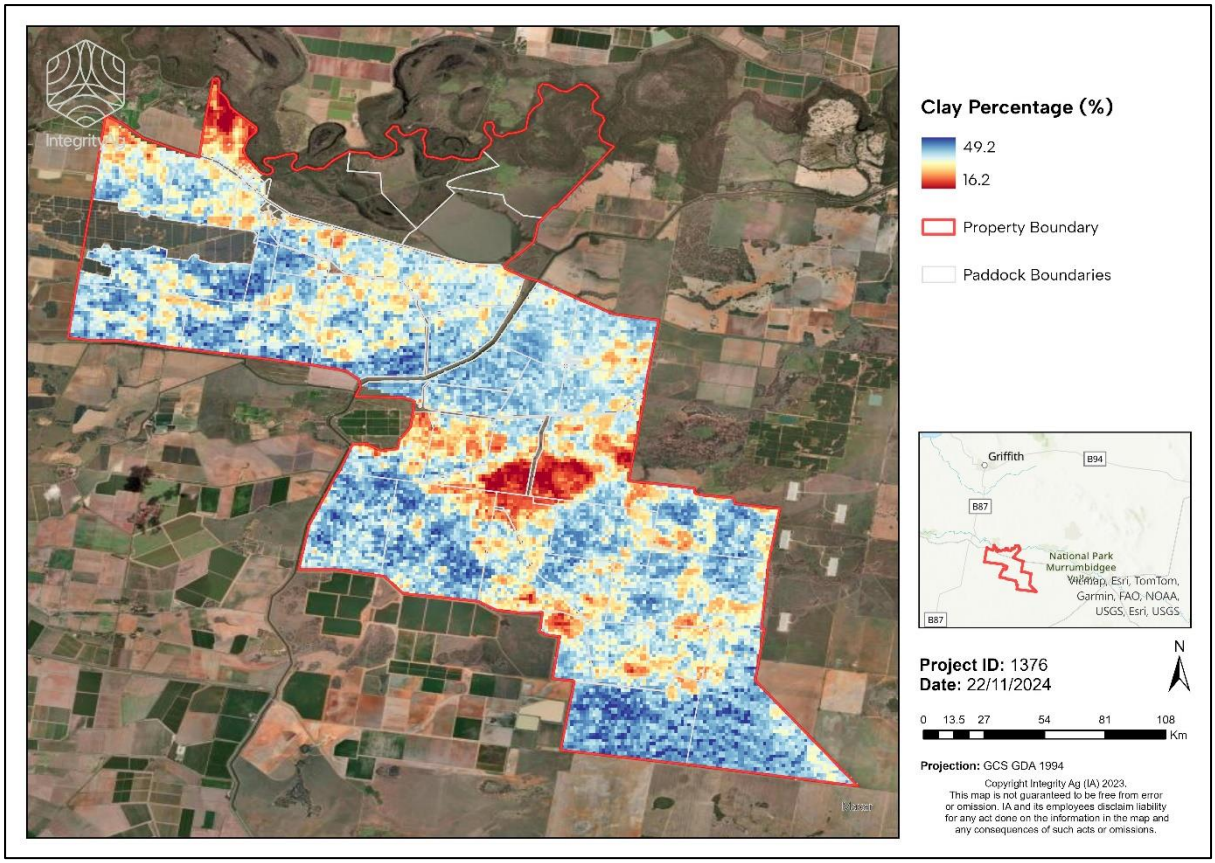

Figure 14. Clay percentage in the top 0-30cm of the soil, using CSIRO data.

Soil Carbon: The predicted SOC from CSIRO modelled data for the 0-30cm layer of soil shows higher SOC concentrations in areas with lower soil disturbance, such as native vegetation. The distribution of estimated SOC indicates that significant amounts of SOC have been lost on cleared or cultivated land areas compared to uncleared native vegetation with similar soil types. This data highlights the impact of land-use and management practices on SOC retention and serves as a useful tool for gauging soil carbon storage potential across different soil types.

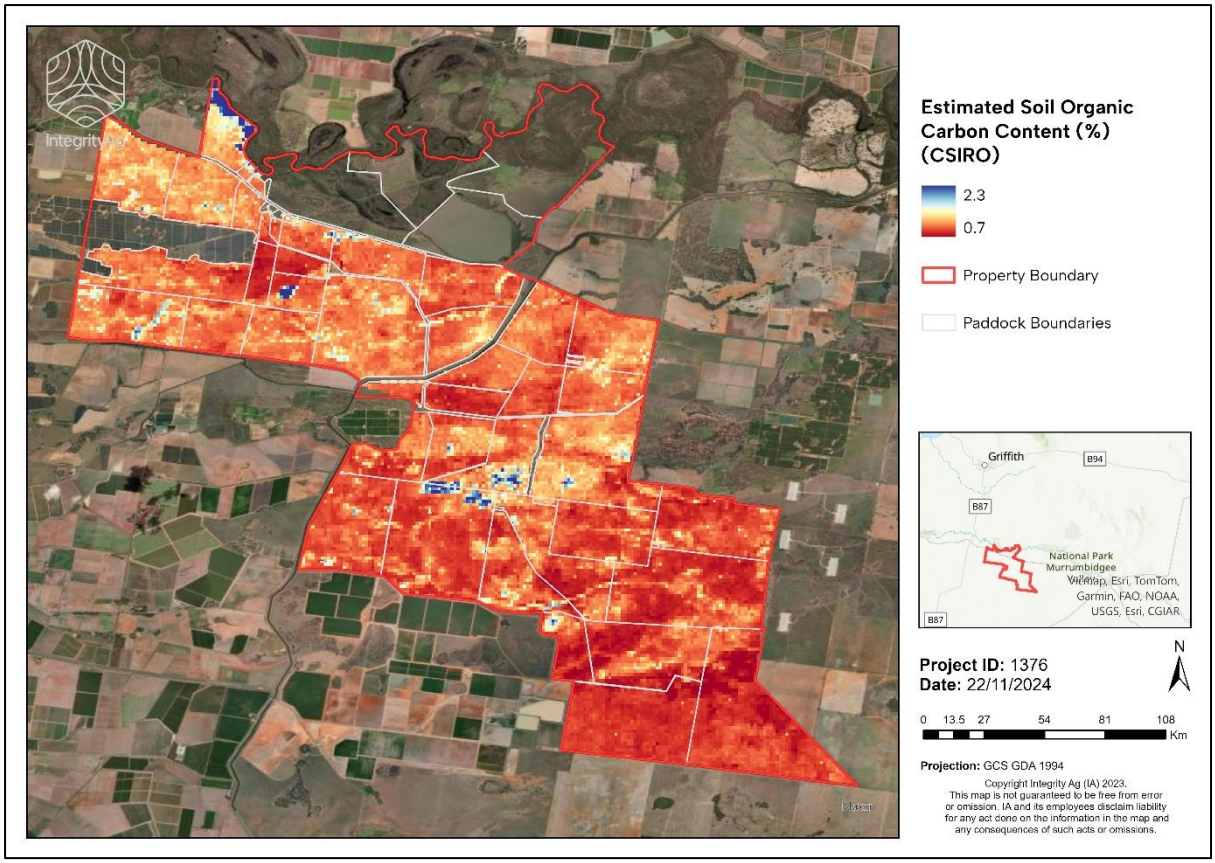

Figure 15. Estimated SOC% in the top 0-30cm of the soil, using CSIRO data

3.3.3. Environmental plantings

Environmental plantings could be assessed across a wide range of the Hewitt property portfolio. Through discussion with Hewitt, two properties were selected to complete a feasibility assessment. The selected property was Tubbo (NSW).

This assessment applied the draft Climate Active guideline *Accounting for Carbon Sequestration from Tree Plantings, September 2022* on the project area. The assessment establishes the following:

- Eligibility for current and future plots including:
  - Minimum plot size equal to or greater than 0.2 ha.
  - Baseline forest cover and historical clearing requirements.
  - Planted species including structure and composition requirements.
- Verification requirements. Third-party verification requirements for a Climate Active project apply either the simplified or full verification process as required. This decision is dependent on the quantum of the annual carbon account and insetting sequestration potential.
- Future plots or areas which are proposed to be planted to a species or vegetation group in the future.
- Carbon sequestration estimates for each plot modelled using the Australian Government's Full Carbon Accounting Model (FullCAM).

Outcomes of the environmental plantings feasibilities are summarised in the results section.

3.3.3.1. Tubbo Site Context

The project area was defined as the respective property boundaries of Tubbo.

A combination of mixed environmental plantings and single species plantings was considered for the property, accounting for increased potential carbon sequestration from single species plantings and additional biodiversity co-benefits associated with mixed environmental species plantings.

FullCAM carbon sequestration data was overlaid against the Tubbo Station property to create a heatmap of potential carbon sequestration ranges across the property. It was identified that the sequestration ranges were variable for mixed environmental species across the property, however, FullCAM was not sensitive to growth rate changes for the single species, and therefore returned a single sequestration value for these types of plantations.

3.4. Emission reduction pathway

The emission-reduction pathway-development process establishes the business's targets and operational approach to emission reduction. Emission reduction considers the techno-economic fundamentals of the emission reduction plan, company culture, stakeholder engagement, governance, targets, and strategy.

A screening assessment of potential options to reduce net emissions was conducted. This screening exercise was conducted with two goals in mind: Hewitt's own enterprise to achieve scope 1 and 2 emission reduction, and for the whole supply chain to achieve emission reduction.

The options were prioritised towards those with the greatest potential to reduce net emissions in the short term and at scale. The screening criteria were as follows:

- Emission source targeted (highest focus placed on highly material emission sources).
- Technical mitigation potential and viability of the intervention.
- Estimated reduction in net HRG emissions based on suitability and adoption rate.
- Economic viability.
- Productivity and co-benefits.
- ACCU Scheme potential.
- Technological readiness and availability.
- Further research and development required.

The net emissions reduction options were segmented by operational function. The options and priorities were discussed with company staff. Outcomes are summarised in the results section.

3.5. Supply chain engagement

Producer workshops were completed by Soil Land Food, and Integrity Ag. This material and approach was developed with input and engagement from Hewitt Foods. This process is outlined in the following sections.

3.5.1. Soil workshops

Soil Land Food assisted Hewitt with a program to support pastoralists, graziers and croppers in the Hewitt supply chain build their ability to manage soil health through structured capacity building activities, including workshops, webinars, one-on-one visits and field days. It aligns with MLA objectives for improved land management.

Soil Land Food delivered producer workshops, and associated sampling and measurement activities during 2023.

The extension program assisted land managers to gain an understanding of their soil issues, and have developed practical knowledge and skills to make land management decisions that help:

- Build drought resilience.
- Restore landscape and soil health.
- Reduce synthetic inputs.
- Inspire practice change for positive outcomes.
- Increase carbon levels in production systems.
- Outcomes of the workshops are summarised in the results section.

3.5.2. Carbon workshops

Integrity Ag developed key content, analysis approach and outcomes, which were piloted in 2023 with a small group of key suppliers through direct engagement.

Additional piloted content was delivered to Hewitt station managers through presentations to their annual meeting in 2023, and through an on-farm workshop held at Pegunny Station in May 2024.

A further engagement session was conducted at the Hewitt supplier day, held at Pegunny in May 2024.

Following this, workshops were rolled out with producers using this material. A review of content and key messaging was completed following each workshop with updates made as required.

Outcomes of the workshops are summarised in the results section.

3.5.3. Market development

Hewitt assessed market opportunities for marketing well-credentialled red meat, including access and verification requirements for certification with selected bodies. Following this assessment, the enterprise elected to establish four carbon neutral products within the Climate Active certification program.

3.6. Climate modelling

The Finite amplitude Impulse Response (FaIR) model (Leach et al., 2021; Millar et al., 2017; Smith et al., 2018) was used to estimate additional temperature increases caused by the scenarios. The FaIR model was configured to run an unmodified copy of the SSP245 scenario against potential herd scenarios. The steps used to calibrate the model were consistent with those shown in the FaIR documentation (FaIR Development Team, 2024).

Emission rates were compared with the IPCC SSP245 (Meinshausen & Nicholls, 2018) pathway by adding the emissions (CO_2, N_2O and CH_4) from the scenarios to that of the SSP245 emission estimates and projections. The temperature anomaly figures presented in this report were determined by calculating the difference between the temperature anomaly from SSP245 (in the order of 0-2 degrees C) and the temperature anomaly from the sum of the emissions from SSP245 and the scenarios.

3.7. Data limitations

Under well managed grasslands in northern grazing conditions, it is not expected that soil carbon changes substantially in response to management in Australia and it is standard to consider soil carbon to have zero change. If small changes in soil carbon were observed across large areas of grasslands, this could have a material impact on the results, where further research and development is needed to provide detection and quantification of carbon stock changes.

Forest cover detection was limited by the availability of current spatial datasets, which were typically only available up to 2023, restricting detection of forest cover change to that time period. Further, detection of forest cover change was not possible in arid regions including for the Narwietooma and Ambalindum properties which resulted in a significant knowledge gap for these properties. Subsequent site-specific evaluation was conducted for these properties, which suggested major regeneration of native forest areas had occurred and may continue to occur. Bespoke methods have been evaluated to determine change in these environments.

Vegetation-based carbon stock change within forested land (forest remaining forest) is difficult to detect and quantify with currently available methods and was not assessed in this study. This was immaterial within the context of this account though further research is needed to improve detection and accounting from this land class. Similarly, change in sparse cover, including shrubland, was not assessed but was shown to result in significant carbon sequestration in rangeland areas by Henry et al. (2015) and is an area requiring further investigation to improve detection and carbon stock accounting. Forest cover mapping for LULUC detection was reliant on national datasets which are subject to inherent errors (omissions and commissions).

No suitable methods were currently available to account for LULUC impacts from scope 3 sources. These may be material for scope 3 livestock purchases, and this represents an important area of further research to improve quantification of emissions or removals in the supply chain.

Natural capital and deforestation calculations were similarly reliant on external datasets with their own limitations.

Livestock emissions accounting was limited by the practicalities of collecting livestock data at a granular level at large scale. Data quality improved over the two years of assessment and were considered auditable in the 2023 year.

Livestock emissions are known to vary when animals graze some pastures such as Leucaena (Stifkens et al., 2022; Tan et al., 2011) and some native shrubs (Durmic et al., 2022). In the present study, emissions were accounted with the generalised equation of Charmley et al. (2016) as used in the NGGI, which was conservative considering some Leucaena pastures have been established and cattle in rangeland areas may graze a significant proportion of their diet from shrubs (Graetz & Wilson, 1980; Pahl, 2019).

4. Results

4.1. Carbon baseline

4.1.1. Scope 1 and 2 carbon account (excl. LU, dLUC)

The CY22 and CY23 annual GHG business emissions (scopes 1 and 2) for the beef herd and sheep flock are reported in Table 9, noting that the CY23 analysis was expanded to include pork production for completeness. Scope 1 and 2 emissions excluded emissions associated with land use and direct land use change (LU and dLUC) which were reported separately in the following sections. Emissions were dominated by enteric methane, and, to a lesser extent, manure nitrous oxide. Impacts from services were very low in comparison to the large sources of livestock emissions. The large contributions from methane were expected in a livestock enterprise and the contribution of cattle compared to sheep directly related to the difference in overall stocking rates in each.

Table 9. Carbon Account – scope 1 & 2 emission sources (t CO_2-e) for CY22 and CY23

Year		2022	2023
Enterprise/Activity	**Emission Source**	**Scope 1 & 2**	**Scope 1 & 2**
Beef	enteric methane	189,656	182,682
	manure methane	2,326	2,241
	manure nitrous oxide	7,012	6,780
	indirect nitrous oxide	737	713
Beef livestock emissions subtotal		***199,732***	***192,416***
Flock	enteric methane	14,043	16,296
	manure methane	667	772
	manure nitrous oxide	870	1,026
	indirect nitrous oxide	91	108
Flock livestock emissions subtotal		***15,671***	**18,203**
Services	Beef & Sheep	3,386	4393
	Cropping		760
	Gosford	1,260	1614
	Brisbane	33	7
Services sub-total		**4,679**	**6,774**
Pork*	Primary production		1,764
	Services		1,041
Pork subtotal			**2,804**
Whole enterprise		**220,082**	**220,197**

**Pork was not assessed within CY22 assessment*

4.1.2. Scope 1 Land use and direct land use change

Emissions and removals from LU and dLUC sources remain less certain and subject to unclear guidelines. Noting the high level of uncertainty, analysis is ongoing to improve certainty and provide results that can be reported publicly.

4.1.3. Scope 3 carbon account

Scope 3 emissions represent emissions that occur as an indirect consequence of business activities. Assessments were completed for CY22 and are displayed in Table 10. Assessments for CY23 are displayed in Table 11 . This analysis was completed within the guidance of GHG Protocol, cited in the AASB standard, and displayed with the 15 categories of scope 3 emissions listed. The CY22 analysis considered data which was less segmented than data received in CY23. Table 11 outlines the main emission sources for the business unit of Hewitt Food (HF) or Hewitt Agribusiness (Agri) identified. Table 10 summarises the total scope 3 emissions, and their corresponding allocation to the 15 GHG categories. Major differences between the years were related to major livestock purchases made as part of property acquisitions, which were accounted in 2022.

Table 10. Scope 3 emissions (t CO_2-e) by GHG Category and their % contribution for 2022 and 2023

Category	Description	2022		2023	
		t CO_2-e	% contribution	t CO_2-e	% contribution
1	Purchased goods and services	838,568	97%	434,054	86%
2	Capital goods	n.r		3,339	1%
3	Fuel and energy-related activities	1,214		1,224	<0.5%
4	Upstream transportation and distribution	7,001	<0.01%	14,141	3%
5	Waste generated in operations	n.r		91	<0.5%
6	Business travel	n.r		1,067	<0.5%
7	Employee commuting	n.r		388	<0.5%
8	Upstream leased assets	n.r		n.r	
9	Downstream transportation and distribution	n.r		n.r	
10	Processing of sold products	15,660	0.02%	21,326	4%
11	Use of sold products	n.r		9,096	2%
12	End of life treatment of sold	n.r		n.r	
13	Downstream leased assets	n.r		6,000	1%
14	Franchises	n.r		n.r	
15	Investments	n.r		11,204	2%
Total		**862,443**	**100%**	**501,929**	**100%**

Table 11. Scope 3 emissions disaggregated for purchased inputs (cat 1) reported in t CO_2-e and % contribution for 2022 and 2023

Description	Category	2022		**2023**	
		Total (t CO2-e)	% contribution	Total (t CO2-e)	% contribution
HF - Purchased beef	1	251,088	30%	255,548	59%
HF - Boxed meat purchases	1	300,661	36%	101,634	23%
HF - Purchased lamb	1	17,365	2%	33,239	8%
Agri - Purchased Cattle (live)	1	251,258	30%	24,606	6%
Agri - Other purchased goods and services	1	1,326	0.2%	6,108	1%
HF - Purchased pork	1	n.r		6,008	1%
Agri - Purchased sheep (live)	1	18,084	2%	4,482	1%
HF - Other purchased goods and services	1	1,326	<0.5%	1,216	<0.5%
Agri - Custom feeding	1	n.r		1,040	<0.5%
HF - Purchased chicken meat	1	n.r		156	<0.5%

4.2. Product Carbon Footprint – Hewitt

The product carbon footprint is a measure of the emissions associated with liveweight produced. It is an efficiency metric for cattle and sheep that are closed out (moved off the property) during the year and uses a value chain emission boundary accounting for all impacts associated with production. Benchmarks have been reported here, showing emissions in kg CO_2-e per kg of live weight (LW) from Hewitt (Table 12) for CY22 and CY23. The assessment includes all turnoff categories and pre-property emissions from purchased cattle, sheep and fuel.

During CY22, scope 1 enteric methane contributed 89.4 % and 64.2 % of the average herd emissions by gas type in each herd and flock, respectively. Scope 3 emissions from purchased livestock contributed 5.3 % to Hewitt's cattle average herd carbon footprint and 25.9 % to Hewitt's sheep flock average carbon footprint (Table 12). While not the focus of the study, the sheep flock produced wool, and impacts were allocated to wool on a protein mass basis. Impacts were 30.6 kg CO_2-e kg greasy wool sold^{-1}. During CY23, both beef and sheep inventories had a change in emission distribution with an increase in beef emissions relating to purchased cattle, and a decrease in sheep emissions relating to purchased sheep.

Table 12.Product carbon footprint (scope 1, 2 & 3) (kg CO_2-e kg LW sold^{-1}) showing breakdown by source in CY22 and CY23

Gas	Beef		Sheep	
	2022	2023	2022	2023
Enteric methane	89.4%	80.4%	64.2%	69.0%
Manure methane	0.1%	1.0%	3.0%	3.3%
Nitrous oxide	3.9%	3.3%	4.4%	4.8%
Services	1.4%	1.7%	2.5%	4.0%
Purchased livestock	5.3%	13.5%	25.9%	19.0%
Carbon Footprint (kg CO_2-e kg LW sold^{-1})*	16.0	17.2	10.3	10.7

4.2.1. Product Carbon Footprint - third party suppliers

Through direct engagement with the supply chain, a large proportion of supplier cattle purchased by Hewitt over the hooks were assessed covering 2022 and 2023. A summary of supplier data is displayed in Figure 16 16. These analyses covered >60% of supplied cattle, with the residual purchased from a larger number of small or periodic suppliers.

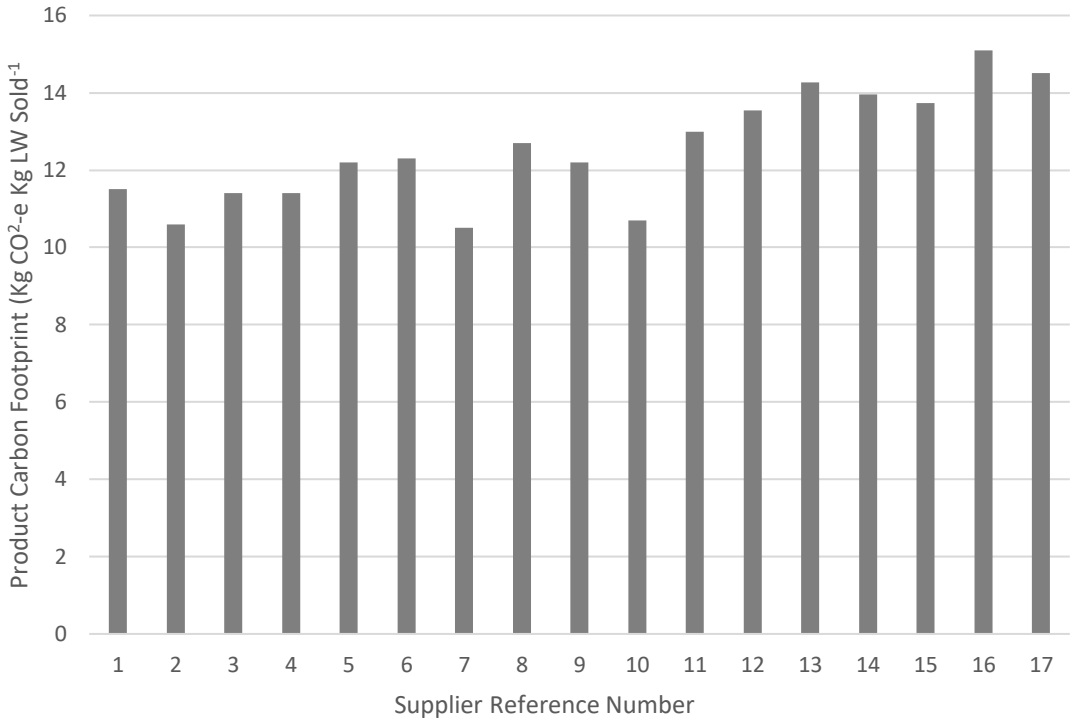

Figure 16. Product carbon footprint for beef supply, informed by primary supplier data

Emissions assessment of sheep purchased over the hooks assessed by primary data supplied by producers is displayed in Figure 17.

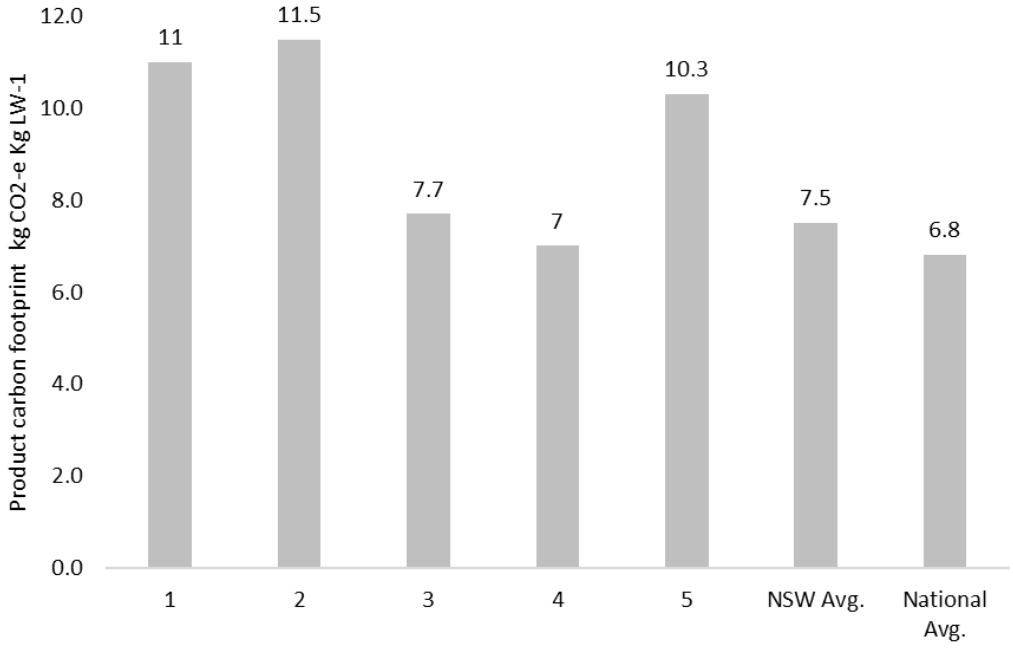

Figure 17. Product carbon footprint for sheep supply, informed by primary supplier data

4.2.2. Analysis of livestock processed and sold through the Hewitt meat supply chain

The carbon footprint results for Hewitt stations and Hewitt suppliers represented herd averages. In some cases, significant numbers of livestock were sold from these properties into other supply chains. To determine impacts from the Hewitt meat supply chain and develop an accurate product carbon footprint for the retail brands operated by the company, impacts from the actual supply was assessed, which reflected a weighted average of the supplier group. To further investigate performance, an analysis based on individual cattle performance data at processing was undertaken, which supplied insights on supply region, supplier, weight, and age of cattle. These results differed from the property scale analysis, because they reflected only the specific animals purchased and the performance of these animals. In some cases, this resulted in lower emissions than the herd average results (i.e. Table 12, Figure 16).

The data from processing records were stratified and analysed by HSCW, ADG, and dentition. The relationship between these modelled variable are displayed in Figure 18, Figure 19, Figure 20, and Figure 21.

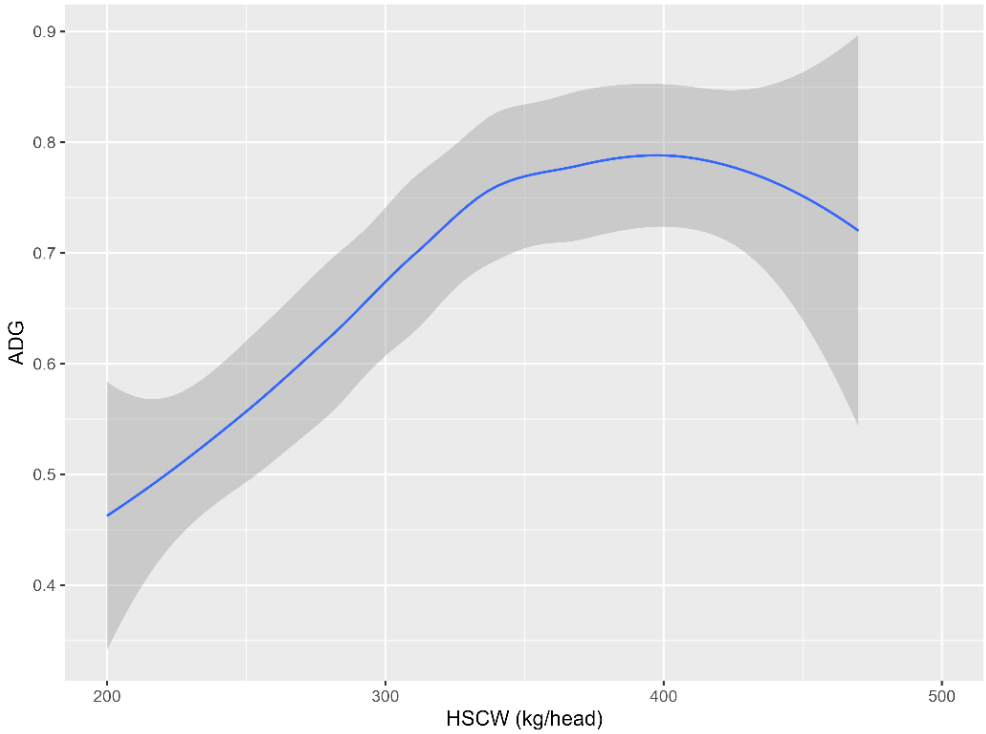

Figure 18. Relationship between ADG (Kg/Head/Day) and HSCW (Kg/Hd)

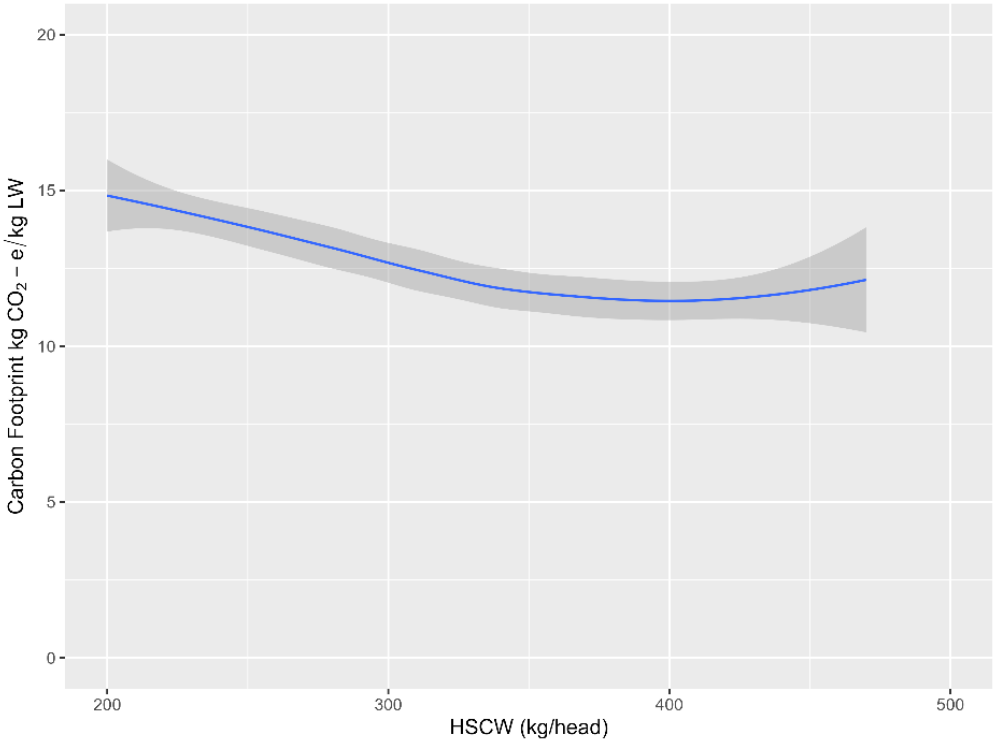

Figure 19. Relationship between product carbon footprint and HSCW

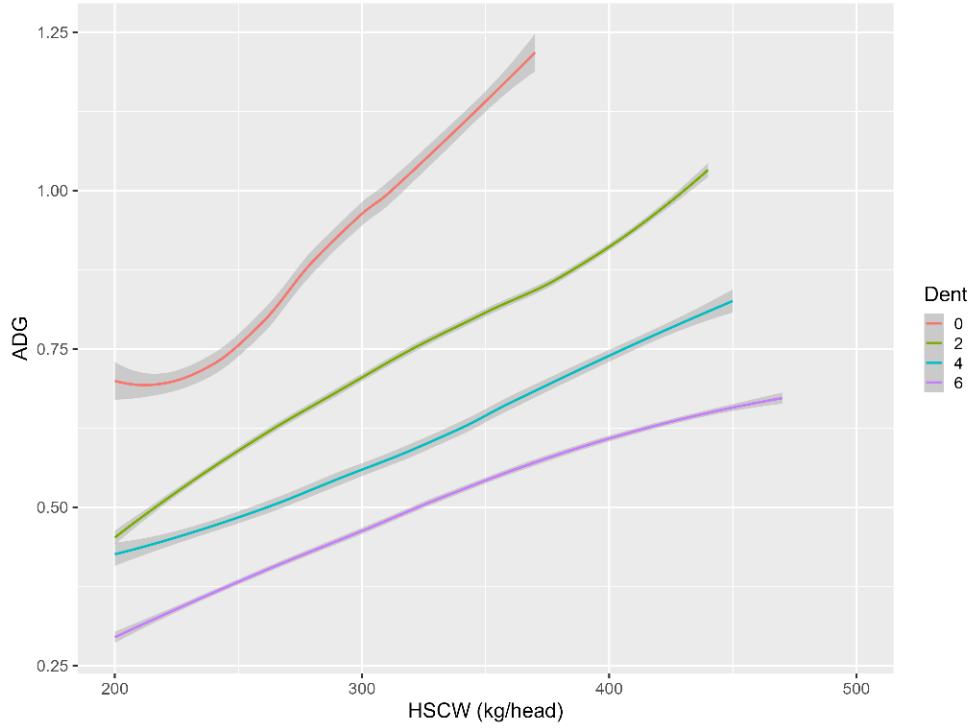

Figure 20. Relationship between ADG (Kg/Hd/Day), HSCW (Kg/Hd) and Dentition

The relationship between product carbon footprint (excl. LU, dLUC), HSCW and dentition is shown in Figure 21. This revealed the increasing impacts of carbon footprint relating to age (dentition) and weight. These trends showed a strong relationship between younger and heavier cattle and lower carbon footprint cattle, suggesting that market metrics can support lower carbon footprints.

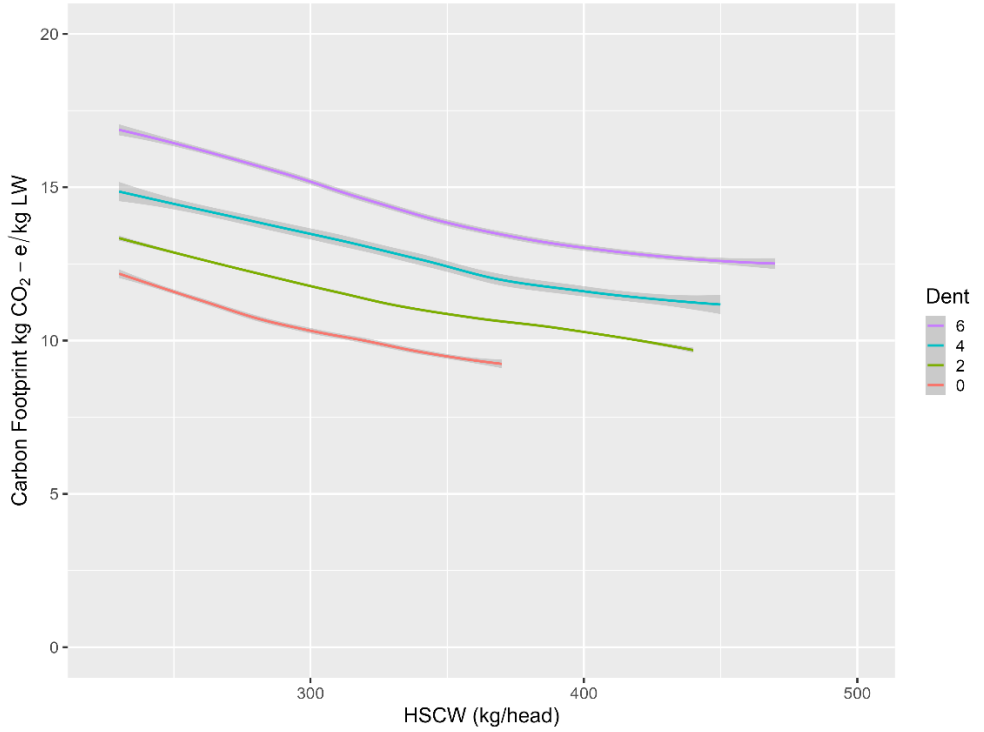

Figure 21. Relationship between product carbon footprint, HSCW and dentition

There was a distinct trend in carbon footprints (excl. LU, sLUC) between regions, which indicated the extensive Central Australian and North Queensland pastoral regions being associated with slower growing cattle from lower productivity herds, which display higher carbon footprint results. This analysis is displayed Figure 22.

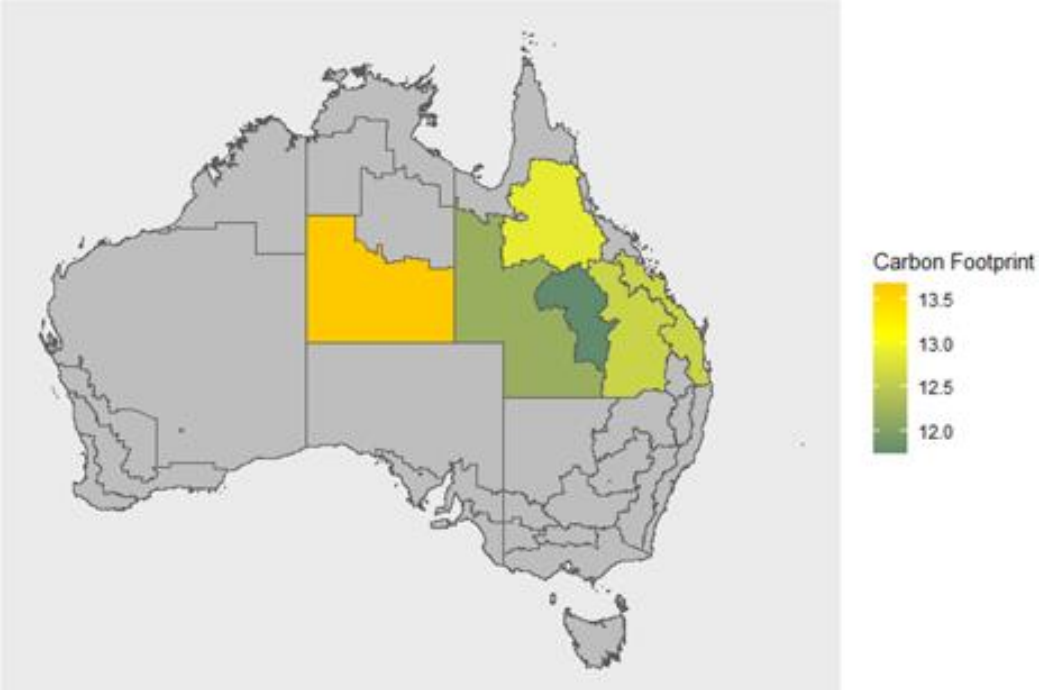

Figure 22. Regionally modelled product carbon footprint analysis

For CY2023, beef supplied to Hewitt Foods, from all sources including Hewitt cattle, had a carbon footprint of 12.6 kg CO_2-e kg LW^{-1} excluding LU, dLUC, for slaughter ready cattle. For CY2023, lamb supplied to Hewitt Food from all sources including Hewitt, had a carbon footprint of 8.5 kg CO_2-e kg LW^{-1} excluding LU, dLUC, for slaughter ready sheep.

4.3. Natural capital and biodiversity baseline

Results demonstrated a spread of aggregated Econd scores across the four major Environmental Accounts, ranging from 57-82. On an individual station basis, Econd scores ranged from 32 up to 90. Table 13 summarises the overall Econd scores calculated for each property, as well as the aggregated score for the four main Environmental Accounts. Drilling further down, Figure 23 displays the spread of Econd scores across asset classes within each station.

Table 13. Calculated Econd scores for assessed stations

Location	Station/ State Based Account	Econd score
NSW	Brewarranna	42
	Bylong (pilot station)	35
	Tubbo	63
	Warilbra	35
	Packsaddle	75
	Tandou	65
	NSW Environmental Account	**67**
QLD	Pegunny	32
	Pony Hills	63
	Alpha Station	38
	Oakwood	51
	Yorkshire	90
	Coolreagh	83
	QLD Environmental Account	**57**
NT	Ambalindum	78
	Numery	75
	Ambalindum & Numery Aggregation	**78**
	Derwent	74
	Glen Helen	84
	Napperby	84
	Narwietooma	56
	Narwietooma Aggregation Account	**82**

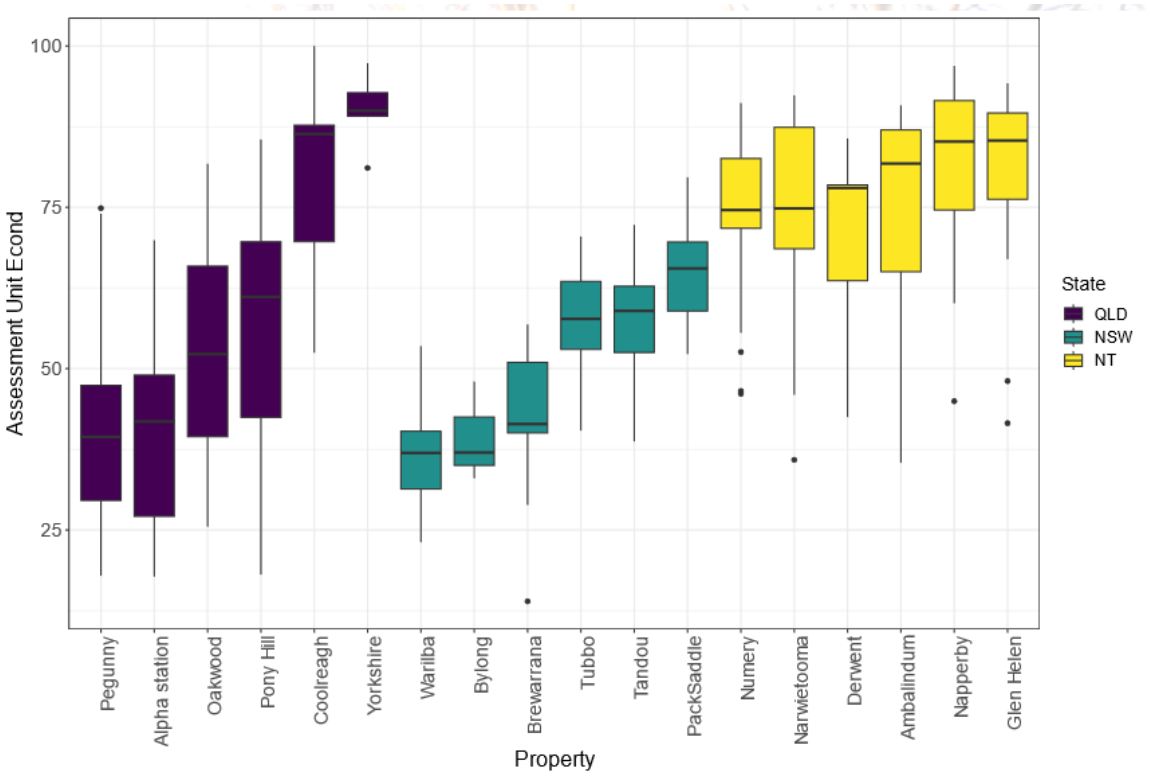

Figure 23. Econd scores across asset classes within each station

Asset Materiality

According to AfN, asset materiality should consider the relevance of each asset and location, consider various elements of significance and risk from differing perspectives (e.g., ecological significance and ecological risk), and rank environmental assets in order of importance. This helps to ensure the most important assets are prioritised for inclusion in the account where resources are a limiting factor.

Bush Heritage's unique asset materiality framework created to provide consistency across Australia, allowing for standardised assessment and decision-making across different regions or properties. By employing a uniform approach, Bush Heritage can effectively compare and prioritise ecological assets. This concept serves as a valuable tool for land managers in determining the allocation of resources and efforts toward the protection and conservation of specific elements within the environment.

Furthermore, the tiering process aids in data summarisation. Through the calculation of average and maximum values and subsequent tiering, complex ecological data can be simplified and summarised. This simplification facilitates communication and decision-making for conservation and management purposes.

Table 14 illustrates how these priority rankings are considered, and then summarised to support the tiering process. The outcome of this ranking leads to a Tier Score, which is produced by a calculation of all the rankings displayed. The Tier allocation takes all these ranking factors into account and translates as Tier 1 = of highest ecological value and Tier 4 = of lowest ecological value.

Table 14. Key criteria underpinning Bush Heritage's Asset Materiality framework

Criteria	**Rank**			
	4	3	2	1
Ecological Significance	Endangered ecosystem or species	Moderately significant	Not threatened, or culturally significant	NULL
Rarity	Rare	Relatively common	Very common	Very common
Reservation	High	Medium	Low	No representation
Uniqueness (Water aspect)	High	Medium	Low	No representation
Threat status	High	Medium	Low	No representation
Biodiversity Status	Endangered	Concern/Of concern	Of Concern	Least concern
Endangered Flora	Endangered	Threatened/Vulnerable	Common	Common
Endangered Fauna	Endangered	Threatened/Vulnerable	Common	Common
Threatened ecological communities	Endangered	Threatened/Vulnerable	Common	Common

The Julia Creek Aggregation (QLD) comprising Yorkshire and Coolreagh, as well as Tandou and Packsaddle (NSW) demonstrated a high proportion of Tier 1 assets (refer Figure 24). An example breakdown of the asset types contributing to the overall Tier results can be seen within Figure 25.

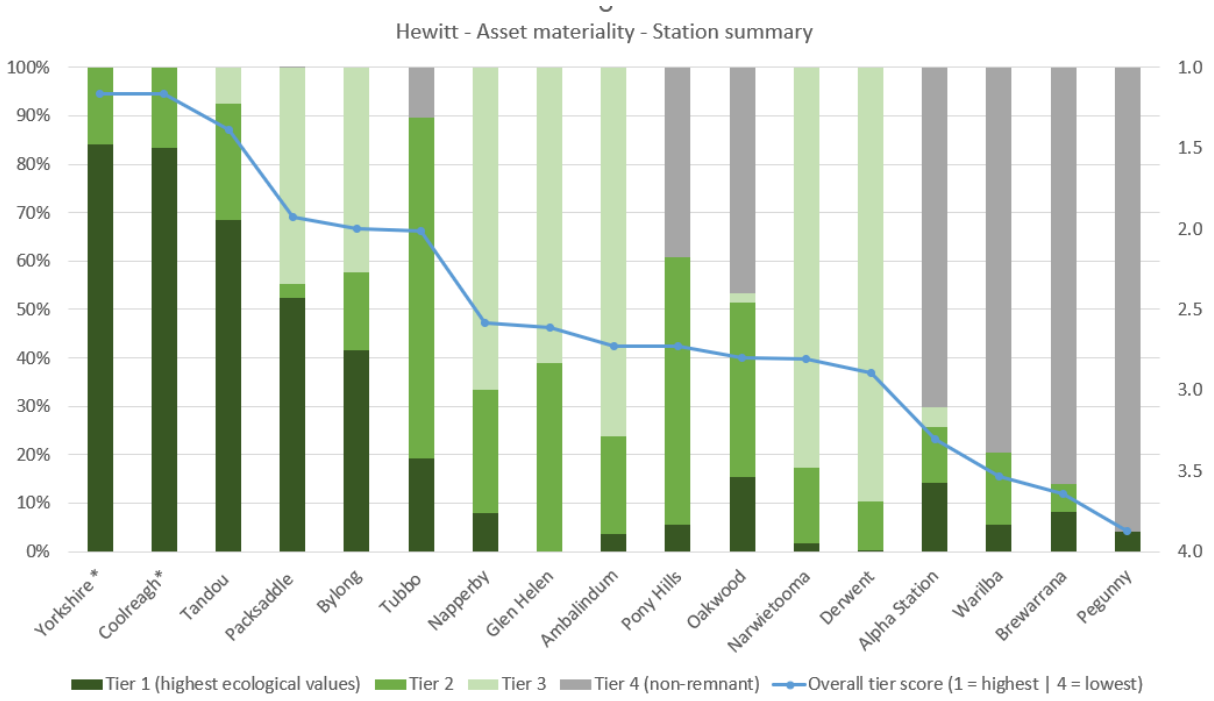

Figure 24. Asset materiality assessment results for stations within scope

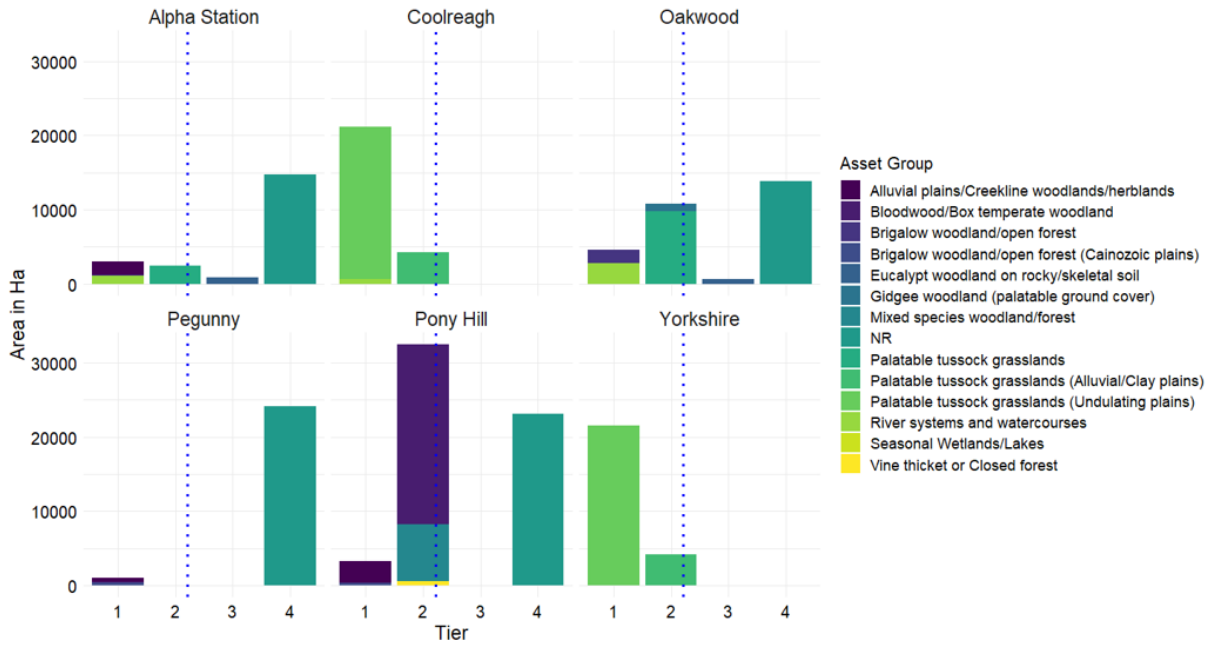

Figure 25. Example of contributing asset types driving overall Tiering results for properties

Field assessment

Field assessments were conducted to assess the composition and health of native vegetation on each station. Given this was the first time the properties in scope were assessed under NV-10, findings from these assessments formed a baseline. This baseline offers an important reference point to measure against in subsequent assessments, particularly where changes in management practices have occurred.

NV-10 specifies field assessments at a frequency of once every 5 years, however a higher frequency may be appropriate for threatened ecological communities, or if the assessment area has incurred a significant disturbance such as a wildfire or flood. Field assessments are performed by a combination of drone (high-resolution remote data sensing) and ground based ecological measurements. A summary of assessment indicators can be viewed within Table 15.

On-ground sampling plots are located within the boundary of the associated remote sensed plot (at least 5 ha). The locations of the on-ground survey plots are recorded using a GPS so that sites can be relocated for re-assessment in following years. For each remotely sensed survey area there are three plots where on-ground data are collected. Various quadrant plots are assigned to assess the indicators. Results are entered into an electronic Survey123 form via a field tablet.

High-resolution remote sensing enables rapid and efficient surveying of ecosystem attributes. Remotely sensed data can be collected using a broad range of tools such as terrestrial laser scanners (TLS), copter and fixed wing UAVs, Aircraft, sensors such as RGB, LIDAR, etc. For this project Bush Heritage utilised a DJI Mavic 3 Multispectral drone.

The three criteria that must be met for the collection of remote sensed data under NV-10 are:

1. Aerial coverage is sufficient for a sampling plot size of 5 ha or greater, and data collection and pre-processing steps are documented.
2. The pre-processed data is fit for purpose.
3. Statistically robust Methods are used to assess the accuracy of attributes, and accuracy meets pre-defined thresholds.

Throughout this project, 877,030 drone images and 110,753 ecological data points were collected across the selected 14 properties.

Validation of mapped stratifications is also an important component of the field assessment activity. All desktop assigned vegetation types are required to be validated and corrected where necessary based on on-ground observations.

Table 15. Field assessed indicators under NV-10

Indicator	Drone based	Ecologist based
Native tree canopy height	X	
Native tree canopy health score		X
Native tree cover	X	X
Native tree size structure	X	
Native species count (richness) for tree canopy and shrub layer species		X
Native canopy species recruitment		X
Native shrub cover	X	X
Non-native shrub cover	X	X
Native herbaceous (photosynthetic) cover	X	X
Native species count for herbaceous species – graminoids		X
Native species count for herbaceous species - forbs		X
Native species count for herbaceous species - other species		X
Non-native herbaceous cover	X	X
Non-photosynthetic (brown or dead) ground cover, i.e. organic litter	X	X
Coarse woody debris	X	

4.4. Natural capital supply chain pilot

The exposure risk assessment (Table 38) revealed following assets, impacts and dependencies were most material to Hewitt:

- GHG emissions.
- Forest cover and deforestation.
- Regenerative agriculture

Further assets and impacts and dependencies also deemed material to Hewitt are:

- General biodiversity and ecosystem condition.
- Threatened plant and animal species.
- Land conservation and restoration.
- Water use and quality.
- Soil health.
- Carbon sequestration.

These material assets form the basis for the 50 asset registers undertaken for each property / aggregation along with other industry specific assets (refer to property reports for results). To facilitate assessment, each register includes the following:

- A table for impacts and a separate table for dependencies, with each asset's metric, score and locality comparison to understand how the property is performing compared to the surrounding area (10km buffer).
- columns for risks and opportunities to help suppliers evaluate the potential consequences of natural capital degradation or loss on their operations, and to highlight potential benefits from enhancing or restoring natural capital. These elements assist suppliers in prioritising natural capital management and implementing targeted improvements.
- The purposes of the registers are not to criticise management or compare with other suppliers, but simply to be used as a starting point for considering opportunities for future improvement.

Individual reports were produced and issued as pdfs to each of the 13 Hewitt portfolio properties and the 37 supplier properties. The 37 supplier properties reports and registers were template based to enable scalability. Each Hewitt portfolio property received a stand-alone report. The two individual Hewitt properties/aggregations received a stand-alone register, while the four Hewitt property groupings received a register per grouping, and not per property in the grouping.

The results for the nine natural capital assets directly measured, are reported per property for the Hewitt portfolio in Table 16, and in property clusters for external suppliers (not reported) to manage confidentiality. For each property cluster, a base score is shown with a weighted score based on area. It is important to note that scores may be naturally low for some regions (e.g. properties in arid regions will have naturally low forest cover scores).

Table 16. Scores for the seven natural capital assets directly measured, or reported for each Hewitt portfolio property and averaged by aggregation.

Asset	Score													
	Bylong	Julia Creek Aggregation	Narwietooma Aggregation	Ambalindum	Pegunny	Pony Hills	Alpha	Oakwood	Tandou	Packsaddle	Tubbo	Warilba	Brewarrana	Weighted average (%)
Property area (ha)	10,944	50,908	1,108,712	545,586	26,722	63,429	22,459	29,548	124,440	41,718	16,335	1,782	3,302	
Proportion of area (%)	1	2	54	27	1	3	1	1	6	2	0.8	0.09	0.16	
Forage / Soil condition	56	59	54	56	52	26	55	54	68	56	49	52	51	54.8
Forest cover extent	37	0.24	9	2	6	49	18	4	3	1	11	8	7	7.8
Forest based pasture benefit	54	81	78	81	76	43	68	81	80	80	75	76	78	78
Forest connectivity	90	45	79	65	81	94	87	68	69	53	78	79	71	73.8
Riparian forest extent	26	2	9	4	20	55	21	9	14	3	38	23	28	9.9
General habitat condition	53	48	43	43	43	48	38	38	8	53	48	53	53	41.3
ECond Score	35	87	56	78	32	63	38	51	65	75	63	35	42	63.1
Significant species habitat condition	83	43	28	33	28	33	28	1	1	53	53	73	68	29.1
GHG Emissions (t/CO_2-e)*	NA	NA	59,922	15,716	NA	NA	NA	NA	NA	NA	10,068	NA	NA	NA

**: Note that separated emissions volumes were not available for most properties, these are included where delineated.*

The consolidated results from the assessments show:

- In general, the Hewitt portfolio and the largest suppliers are performing above average, particularly when compared within a region with respect to the indicators assessed.
- The range of assets to assess are complex, and in some cases a high or low score does not indicate higher performance.
- Risks can be managed to appropriate levels if management actions are undertaken.

To increase supplier engagement, reports were issued using the same general structure. The reports included:

- An introduction explaining Hewitt's approach to natural capital reporting.
- An explanation of what natural capital entails, how producers interact with it, and what it means to them. It is explained that, through the assessment, suppliers will gain a better understanding, with a view on how they can use the information to improve management, increase production, and create opportunities.
- Summary results for the nine natural capital assets relevant to livestock production that were spatially assessed, along with relevant maps, graphs, and tables. In the appendices, detailed results and how to interpret the metrics and scores for the measured assets are provided.
- Two natural capital registers, generic to the livestock industry for suppliers and more specific for Hewitt portfolio properties.
    - One focuses on assets affected by property operations, and another focuses on assets critical to property operations.
    - Both registers include columns for risks and opportunities to help suppliers evaluate the potential consequences of natural capital degradation on operations, and to highlight potential benefits from improved natural capital.
- Suggestions as to how the results from the report can be of use, such as highlighting productivity or environmental risks, identifying alternative income sources, or providing local context on performance.

4.5. Deforestation

Deforestation is an emerging risk for the sector and a high-level screening assessment was undertaken. At the present time, there is no clarity or certainty on the exact definitions that will be applied and differences are emerging between markets. This made any definitive assessment difficult and further work is needed to understand the risks and requirements around deforestation for market compliance. This is an area of further investigation.

4.6. Insetting and offsetting potential

4.6.1. Native Vegetation

Forest Potential, Forest Cover, and Vegetation Density Requirements

Following the desktop assessment of forest cover and forest carbon, as assessment of the properties potential value as an ACCU project was assessed by screening with the requirements of the human induced regeneration (HIR) method. The property selected for detailed site assessment and analysis was Narwietooma.

A key objective of the site assessment was to determine the geographical areas that may be included in the HIR Carbon Estimation Areas (CEAs). These areas must not be Forest Cover (which must be excluded), nor have been Forest Cover in the last ten years (known as baseline Forest Cover, which must be excluded), yet they must be areas that demonstrate the Potential to reach Forest Cover within less than 16 years and sustain it until the end of the project's permanence period (25 years). Note that Forest Cover is defined as land with native regeneration maintaining more than 20% canopy cover and exceeding 2m in height.

Forest Potential areas were identified as areas that typically had between 5 and 15% canopy cover and had the species composition needed to achieve Forest Cover. They were areas that, with the right management, would likely achieve Forest Cover. During the site assessment, plots measuring 20m by 50m were laid out, and the approximate canopy cover for this 0.1 ha area was calculated via a vegetation survey. The vegetation species were recorded, as were the canopy diameters that these species will reach upon maturity. This data, together with the numbers of saplings, was used to determine the likelihood of an area having Forest Potential.

During the site assessment, mature stands were assessed at multiple locations on the property and average canopy diameters of mature trees were recorded. The primary species that may contribute towards Forest Cover attainment (primarily mulga) are presented in Table 17 below. The diameter of the mature tree is needed to determine how many stems of a species is required to achieve 20% canopy cover. Minimum stem counts to meet Forest Cover and Initial Stratification eligibility requirements are provided below for reference.

Table 17. Vegetation Density Requirements

Common Name	Botanical Name	Mature Canopy Diameter (m)	Stems per ha to meet 20% Forest Cover	Stems per 20m by 50m plot to meet 20% Forest Cover	Stems per 20m by 50m plot to meet Initial Stratification
Weeping mulga	Acacia *paraneura*	5	102	10	5
Slender mulga	Acacia *aptaneura*	5	102	10	5
Broad-leaf mulga	Acacia *ayersiana*	5	102	10	5
Boree, umbrella wattle	Acacia *oswaldii*	6	71	7	4
Broad-winged mulga	Acacia *pteraneura*	4	159	16	8

Vegetation Mapping and Classification Methods

Each ground control survey point was classed as either water, bare earth, grass/shrubland, Forest Potential, or Forest. These points were recorded with pictures and associated with corresponding GPS coordinates and other descriptive data.

To accurately assess the extent of Forest Cover and determine areas for exclusion, advanced GIS classification techniques were utilized. A fully supervised classification using ArcGIS Professional Deep Learning algorithms was employed to enhance the accuracy of the assessment. This technique utilized ground control points and extensive training datasets to identify Forest Cover and areas requiring exclusion. To facilitate the fully supervised classification, training datasets were generated by extending polygons from the survey points in the direction of the relevant vegetation. By leveraging these techniques, a comprehensive understanding of the Study Area's eligible Forest Potential areas was attained. The fully supervised classification is shown in Figure 26.

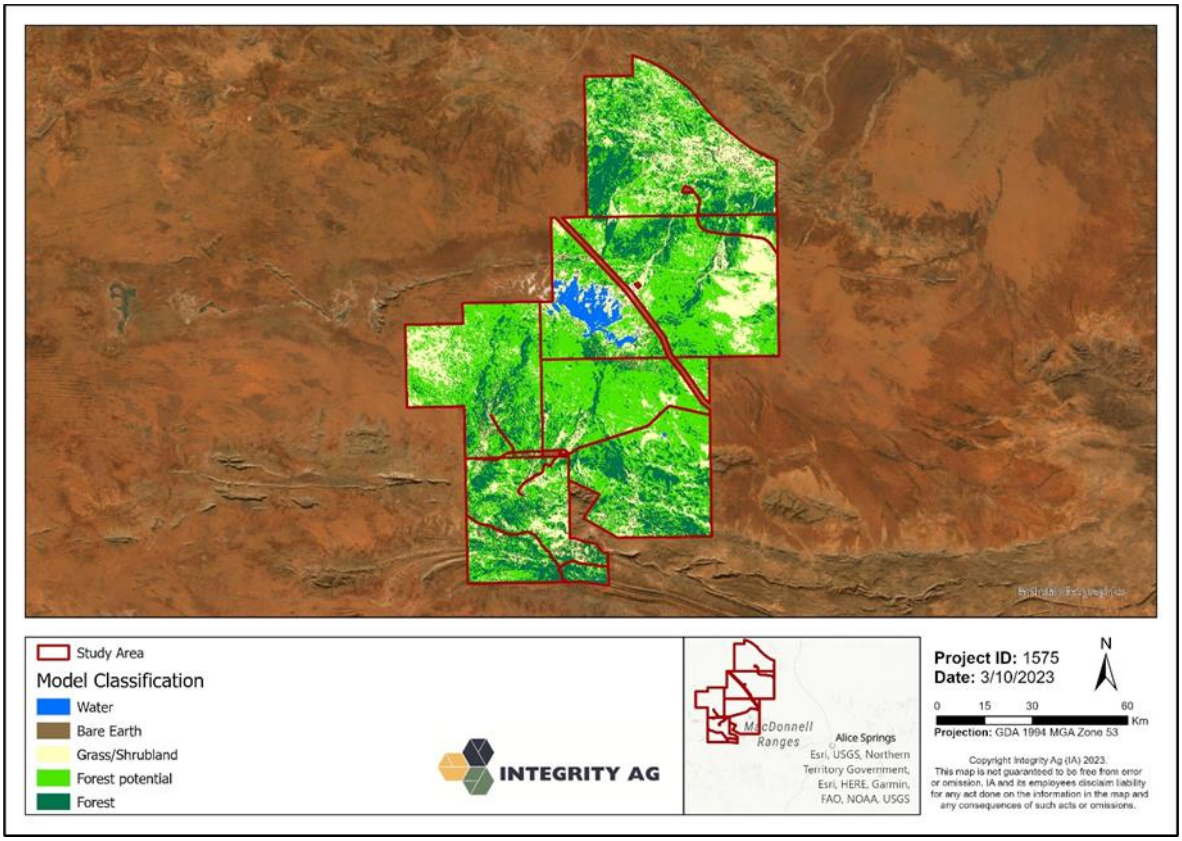

Figure 26. Fully supervised classification using a deep learning algorithm

The accuracy of the classifications is determined by the generation of a confusion matrix, which accounts for correlation and various Potential errors. Confusion matrix analysis (known as map accuracy assessments) indicated that supervised deep learning classification had an overall accuracy of 68%. The mapping and associated accuracy would be further refined during an Initial Stratification (the next stage of a HIR assessment, conducted during an extensive field assessment within the first five years after project registration). As per the Method, areas identified as Forest Cover during the baseline period must be excluded. However, baseline Forest Cover, as defined by the National Forest and Sparse Woody Vegetation Data, could not be erased from the Forest Potential because this data does not exist over the Study Area. As such, the modelled Forest shown in Figure 9 is currently the best indication of Forest Cover.

On request of the CER, two Potential CEAs (high confidence and low confidence) were created. The high confidence CEA is a subset of the low confidence CEA. For the purposes of the economic analysis, the Forest Potential was restricted to only that within the high confidence CEA.

The low confidence CEA exclusively contains land modelled as Forest Potential; land modelled as water, bare earth, grass/shrubland or Forest was removed. Of this Forest Potential, land that had been burnt twice during the baseline period, or had experienced a hot burn (any fire within November, December, January, and February) during the baseline period, was removed. The remaining land was reduced to only include land within the following vegetation subgroups (as per the National Vegetation Information System): Mulga open woodlands and sparse shrublands (MVS 45), Mulga open woodlands and sparse shrublands with hummock grass (MVS 52), Mulga woodlands and shrublands (MVS 20), Acacia low open woodlands and sparse shrublands (MVS 24), and Other Acacia tall open shrublands (MVS 21). In addition to the resulting land, any modelled Forest Potential areas within a 1 km of land modelled as Forest was added to the CEA, regardless of the previous criteria. This is because land adjacent to Forest has a higher likelihood of achieving Forest Cover. The resulting land, subject to the above ecological conditions, became the low confidence CEA. The high confidence CEA, a subset of the low confidence CEA, was created by taking the low confidence CEA and only including areas classed as either of the following major vegetation groups (those most likely to reach Forest Cover, as per the National Vegetation Information System): Acacia Open Woodlands (MVG 13) and Acacia Shrublands (MVG 16) (see Figure 3).

Table 18 outlines the relative areas associated with each class of the supervised classification, in addition to the areas evaluated as the high and low confidence CEAs.

Table 18. Areas by Final Classification

Class	Area (ha)
Modelled Water (excluded)	20,057
Modelled Bare Earth (excluded)	33,186
Modelled Grass/Shrubland (excluded)	236,462
Modelled Forest Potential across whole property	535,289
Forest Potential (Low Confidence CEA), (subset of Modelled Forest Potential)	421,543
Forest Potential (High Confidence CEA),(subset of Modelled Forest Potential)	159,037
Modelled Forest (excluded)	276,428

The two Forest Potential figures of 421,543 ha (low confidence CEA) and 159,037 ha (high confidence CEA) are subject to further refinement following the Initial Stratification process. For instance, certain structures, holding paddocks, laneways, and other areas may need to be classed as Exclusion Areas during the creation of the official CEAs (See Section 3.4). These areas are typically refined following management consultations with the proponent during the Initial Stratification.

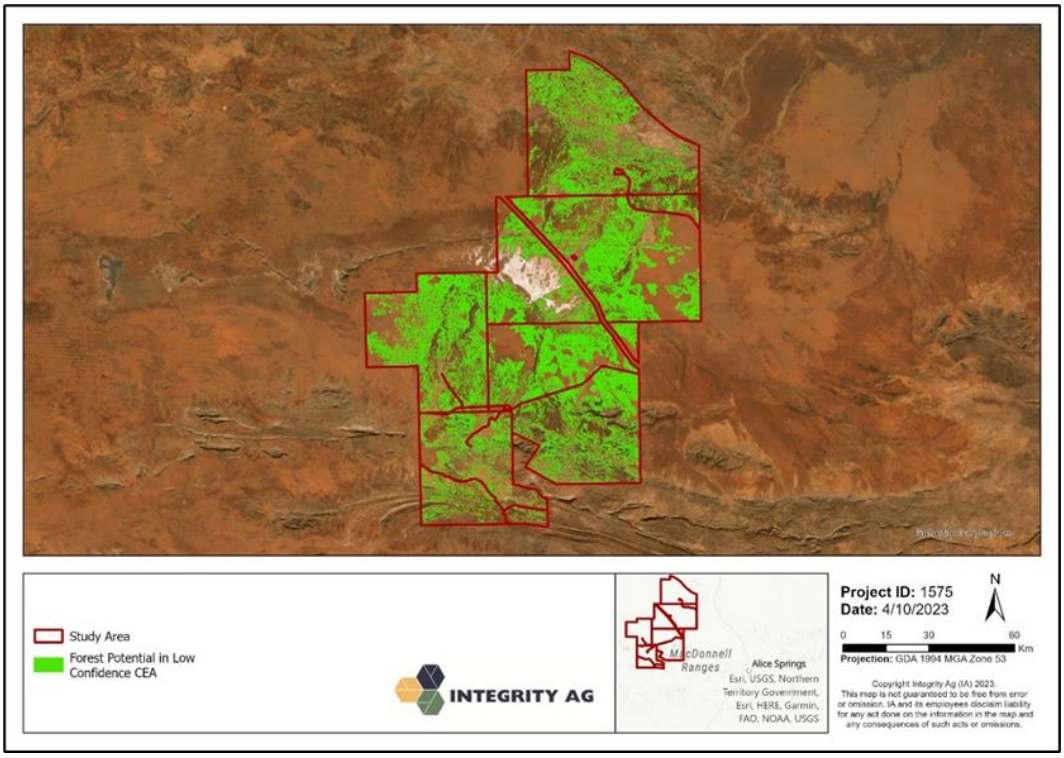

Figure 27 Forest Potential from the supervised classification comprising the low confidence CEA

4.6.2. Soil

Following the desktop assessment of soil carbon, an assessment of the properties' potential value as an ACCU project was assessed by screening with the requirements of the Soil Organic Carbon Sequestration method. The results of these feasibility assessments are presented below.

4.6.2.1. Results for Tubbo and Pegunny

Current SOC Content Estimate: For both Pegunny Station and Tubbo Station, the current soil organic carbon (SOC) content was estimated using the Soil and Landscape Grid of Australia (Wadoux et al., 2022a).

Table 19. CSIRO Predicted SOC Concentrations for Pegunny and Tubbo stations

Depth	Pegunny Station	Tubbo Station
0-5 cm	1.6%	1.6%
5-15 cm	1.3%	1.1%
15-30 cm	1.0%	0.6%
Overall (0-30 cm)	1.2%	1.0%

These baseline values are used for modelling potential SOC increases from the proposed ACCU Scheme soil carbon projects.

Table 20. Results summary table

Category	Pegunny Station	Tubbo Station
Proposed Project Activities	1. Applying nutrients (synthetic or non-synthetic fertiliser) to address material deficiencies. 2. Using legume species in pasture systems.	1. Re-establishing or rejuvenating a pasture by seeding or pasture cropping. 2. Applying nutrients to the land in the form of a synthetic or non-synthetic fertiliser to address a material deficiency.
Carbon Estimation Areas (CEAs)	• **CEA1:** 4735 ha of Vertosols with nutrient application to improve SOC stock. • **CEA2:** 4250 ha of Vertosols with legume species in pasture systems to improve SOC stock. • **See** Figure 28**.**	• **CEA1:** 3430 ha with nutrient application to improve SOC stock. • **CEA2:** 1560 ha with nutrient application to improve SOC stock. • **See** Figure 29**.**
Returns	• Total project area: 9735 ha. • Project area: 8985 ha. • SOC sequestration rates: 0.1 to 0.3 tonnes of carbon per ha per year. • See Table 21.	• Total project area: 5450 ha. • Project area: 4990 ha. • SOC sequestration rates: 0.1 to 0.3 tonnes of carbon per ha per year. • See Table 21.
Cost Estimate:	• The cost of implementing the ACCU Scheme projects includes professional services for verification, project implementation expenses, and soil sampling. The costs vary depending on the number of soil samples taken, with estimates provided for low, medium, and high sequestration rate scenarios. • Direct carbon project costs can be divided into professional services associated with verification (reporting and auditing) and project implementation expenses such as soil sampling.	
Management Implications & Risks:	• Soil carbon projects require regular soil sampling and audits to verify carbon sequestration. Key risks include seasonal impacts on SOC levels and the potential for carbon loss due to management practices. The project proponent must have consent from eligible interest holders and commit to maintaining carbon stores throughout the permanence period. • Soil carbon can rise and fall with seasonal impacts or where management practices that lose carbon are conducted because of other management goals for the land.	

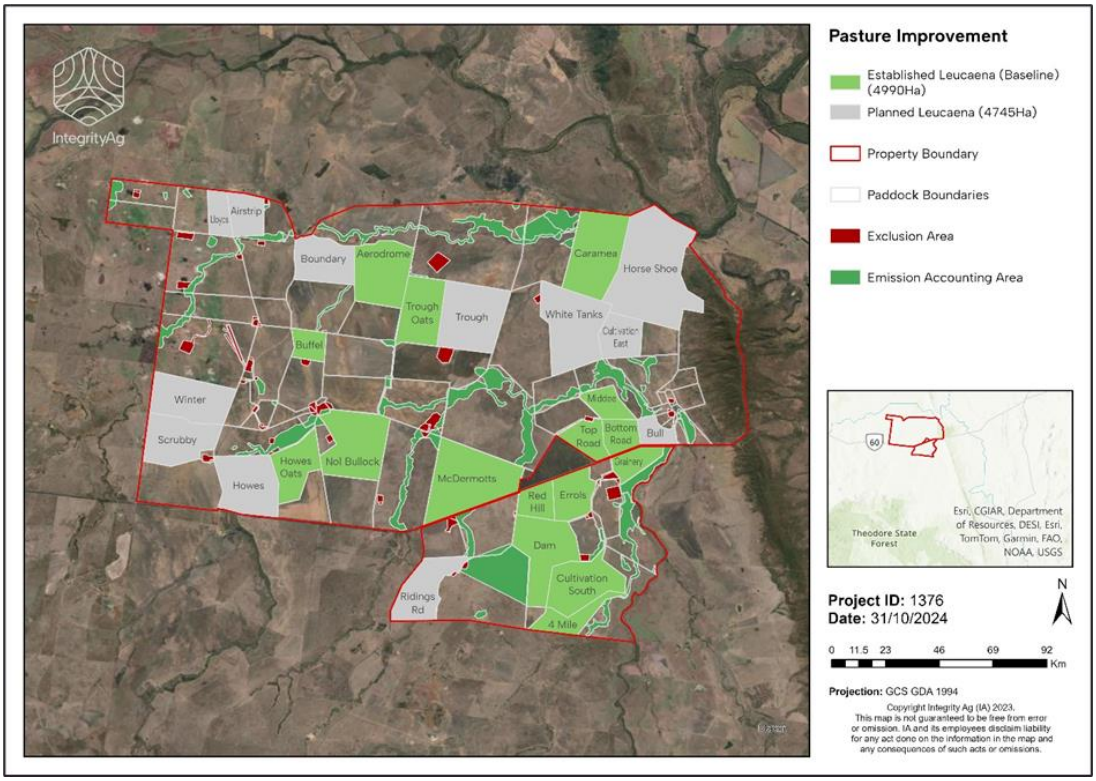

Figure 28. Potential Carbon Estimate Areas & project activities on Pegunny

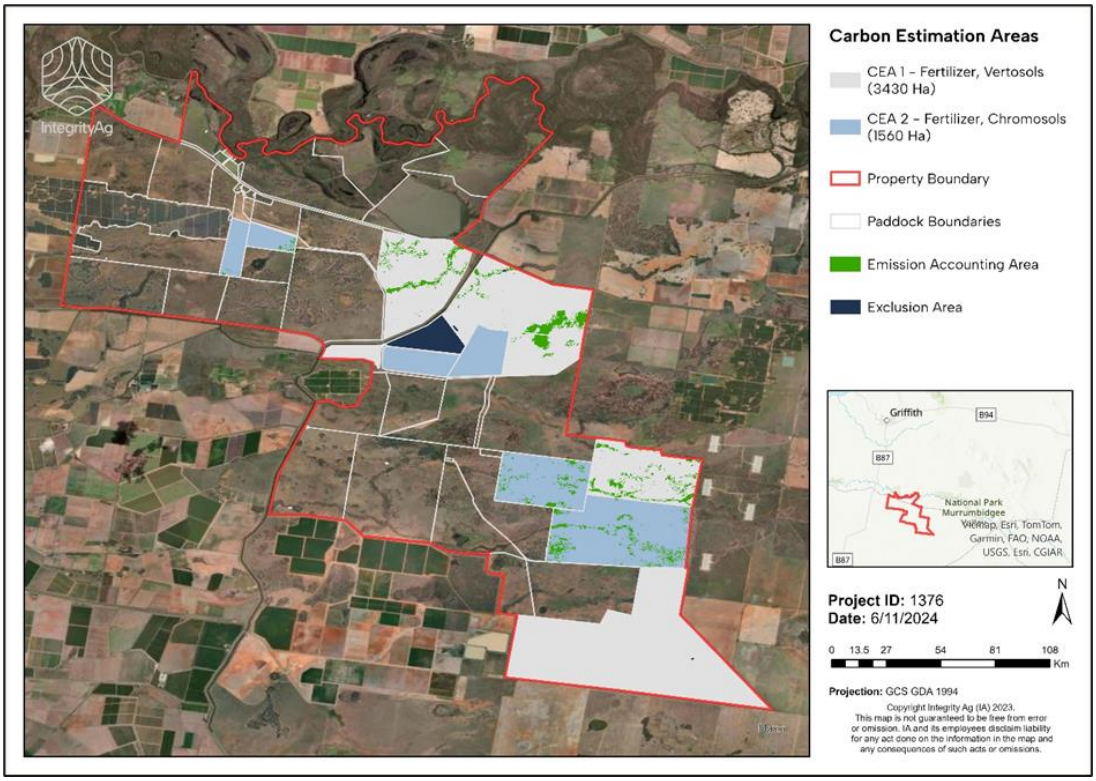

Figure 29. Potential Carbon Estimate Area & activities zones on Tubbo

Table 21. Estimated soil organic carbon sequestration

		Tubbo Scenario			**Pegunny Scenario**		
Forward Abatement Estimate	Units/other	Low	Medium	High	Low	Medium	High
Hectares	ha	4990	4990	4990	8985	8985	8985
Bulk density	g cm^{-3}	1.4	1.4	1.4	1.4	1.4	1.4
Est. residual C from manure applications	t C/ha/yr	0.00	0.00	0.00	0.00	0.00	0.00
Est. C from additionality activity	t C/ha/yr	0.10	0.20	0.30	0.10	0.20	0.30
Est. gross C sequestration	t C/ha/yr	0.10	0.20	0.30	0.10	0.20	0.30
Est. gross sequestration potential (t C/ ha) (project)	t C/ha (project)	2.50	5.00	7.50	2.50	5.00	7.50
Current soil carbon level (0-30cm) (%)	%	1.00	1.00	1.00	1.20	1.20	1.20
Potential soil organic carbon level (%)	%	1.06	1.12	1.18	1.26	1.32	1.38
% change in SOC (per year)	%	0.00	0.00	0.01	0.00	0.00	0.01
% change in SOC (project)	%	0.06	0.12	0.18	0.06	0.12	0.18
Current soil organic carbon stock	t C/ha (0-30)	42.0	42.0	42.0	50.4	50.4	50.4
Potential soil organic carbon stock	t C/ha (0-30)	44.5	47.0	49.5	52.9	55.4	57.9
Annual est. sequestration potential (no deductions) per hectare	t CO_2-e/ha/yr	0.4	0.7	1.1	0.4	0.7	1.1
Annual est. sequestration potential (no deductions)	t CO_2-e/yr	1831	3663	5494	3297	6595	9892
Annual est. sequestration potential after deduction for 25-year permanence & risk reversal buffer (i.e. ACCUs) per hectare	t CO_2-e/yr	1373	2747	4120	2473	4946	7419
Est. sequestration potential after discount for project emissions	t CO_2-e/ha/yr	788	2161	3535	1478	3951	6424
Est. total sequestration potential for the project	t CO_2-e (project)	19688	54025	88363	36938	98766	160594

Next Steps: Both projects appear technically feasible based on the feasibility assessments. The next steps include reviewing ACCU Scheme soil project requirements, confirming SOC levels on-site, and proceeding to project registration and baseline sampling if satisfied with the project's viability.

The limitation of these feasibilities is that they use predicted CSIRO data to estimate the current SOC% levels of the properties, without verified actual soil data to support the baseline estimated SOC% level of the soil or to indicate actual soil carbon variability across the properties.

4.6.3. Environmental plantings

Following the desktop assessment of environmental planting locations, an assessment of the properties potential value as an ACCU project was assessed by screening with the requirements of the Environmental Plantings Method. The results of these feasibility assessments are presented below.

4.6.3.1. Results for Tubbo

Low and high ranges were then tested in FullCAM to identify the potential sequestration ranges for mixed environmental plantings.

Table 22. FullCAM tree planting sequestration rates for Tubbo station

Species and configuration	**Sequestration rate (low-high) over 10 years (t CO_2-e/ha/yr)**
Mixed environmental block	2.4 – 7.8
Mixed environmental belt	4.1 – 13.3

Future Plots are areas which are proposed to be planted to a species or vegetation group in the future, provided for indicative property planning purposes. These plots have been mapped to provide a scenario-based view of the potential for plantings on the property, and are not specifically reflective of locations the property manager is actively considering. Rather, they show the ranges of sequestration for different species, arrangements and locations on the property, for future property planning purposes. Five plots have been modelled consisting of environmental plantings of locally indigenous native species in block arrangements, with a view to targeting areas of potential biodiversity and ecological impact (such as expanding the vegetation along the Murrumbidgee, or connecting corridors in the middle of the property). Three plots have been modelled as mixed environmental belt plantings, arranged as shelter belts and screens along the edges of the property in a number of locations. As any plantings must be free of forest cover in the five years prior to planting, a baseline forest cover analysis was conducted.

Mixed environmental belt plantings have key eligibility criteria which must be met. Eligibility for belt planting modelling requires:

- the distance between the stems of the outermost trees or shrubs must be less than 40 metres across;
- the distance between the stems of trees or shrubs at the outmost edge of the planting must be at least 40 metres from the stems of another planting in the project area; and
- the plot must not be affected by material competition from adjacent trees, as outlined in Division 3.7 of the ERF Reforestation by Environmental or Mallee Plantings method.

Should these requirements not be met, the sequestration modelling would likely be required to revert to the lower sequestering ‘block’ modelling.

The various plantings are summarised in Table 23 and shown in Figure 30.

Exact plot locations and verification requirements will need to be re-assessed once they are included in a future Climate Active carbon account assessment.

Table 23. Tubbo Station scenario Future plots

Plot ID	Plot species	Plot area (ha)	Proposed planting date	X-Coordinate centroid (°E)	Y-Coordinate centroid (°N)
T1	Mixed environmental species - block planting	190	1/07/2023	146.1823	-34.7109
T2	Mixed environmental species - block planting	44	1/07/2023	146.193	-34.6852
T3	Mixed environmental species - block planting	11	1/07/2023	146.1283	-34.6299
T4	Mixed environmental species - block planting	100	1/07/2023	146.0853	-34.6241
T5	Mixed environmental species - block planting	80	1/07/2023	146.1315	-34.6315
T6	Mixed environmental species - belt planting	4	1/07/2023	146.196	-34.6959
T7	Mixed environmental species - belt planting	7	1/07/2023	146.1769	-34.776
T8	Mixed environmental species - belt planting	17	1/07/2023	146.1436	-34.6791
Total		**457**			

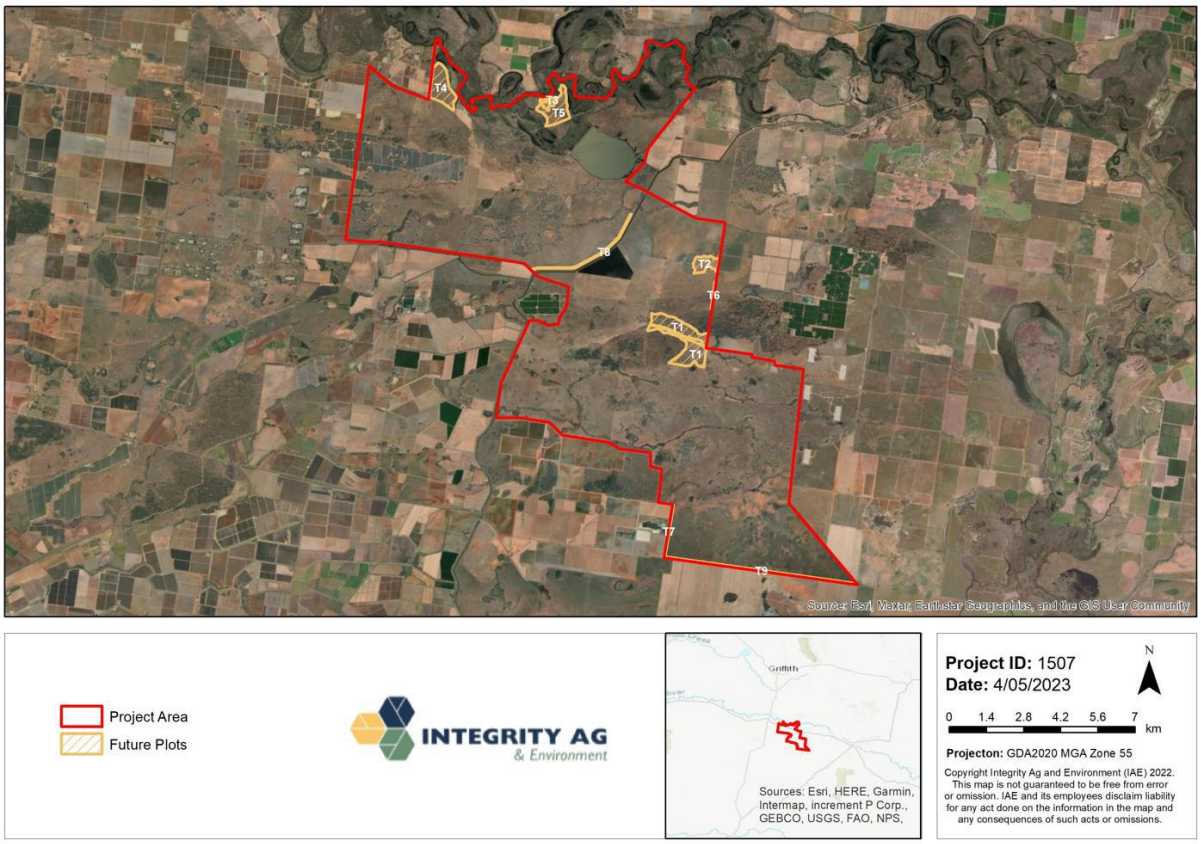

Figure 30. Tubbo station future plots

Potential carbon sequestration for Future Plots was modelled using the Full Carbon Accounting Model (FullCAM, version 6.20.03.0827) in accordance with the Guideline.

Assuming Future Plots are planted on 1 July 2023, estimated carbon sequestration ranged from 255 t CO_2-e in FY23-24 to a peak of 9993 t CO_2-e in FY31-32. With the 30% permanence and risk reversal adjustment applied, this equates to a range of 178 t CO_2-e to 6995 t CO_2-e.

A ten-year projection for the modelled sequestration from Future Plots (including the 30% reduction) to 2033 on a year-by-year basis is provided in Table 24, Figure 31, and Figure 32.

Table 24. Predicted annual sequestration for environmental tree plantings at Tubbo station by plot (t CO_2-e)

Year	T1	T2	T3	T4	T5	T6	T7	T8	Total
FY23/24	166	39	10	87	74	8	12	32	428
FY24/25	302	73	22	144	139	32	45	131	888
FY25/26	848	202	63	400	385	54	76	222	2250
FY26/27	1267	303	94	603	583	61	86	251	3248
FY27/28	1487	355	111	703	680	60	85	249	3730
FY28/29	1555	372	116	737	716	56	80	234	3866
FY29/30	1555	371	116	737	711	52	74	216	3832
FY30/31	1506	359	112	716	690	47	68	197	3695
FY31/32	1438	345	107	680	659	43	62	180	3514
FY32/33	1360	324	101	644	623	39	56	163	3310
Total	11484	2743	853	5452	5260	452	643	1876	28761

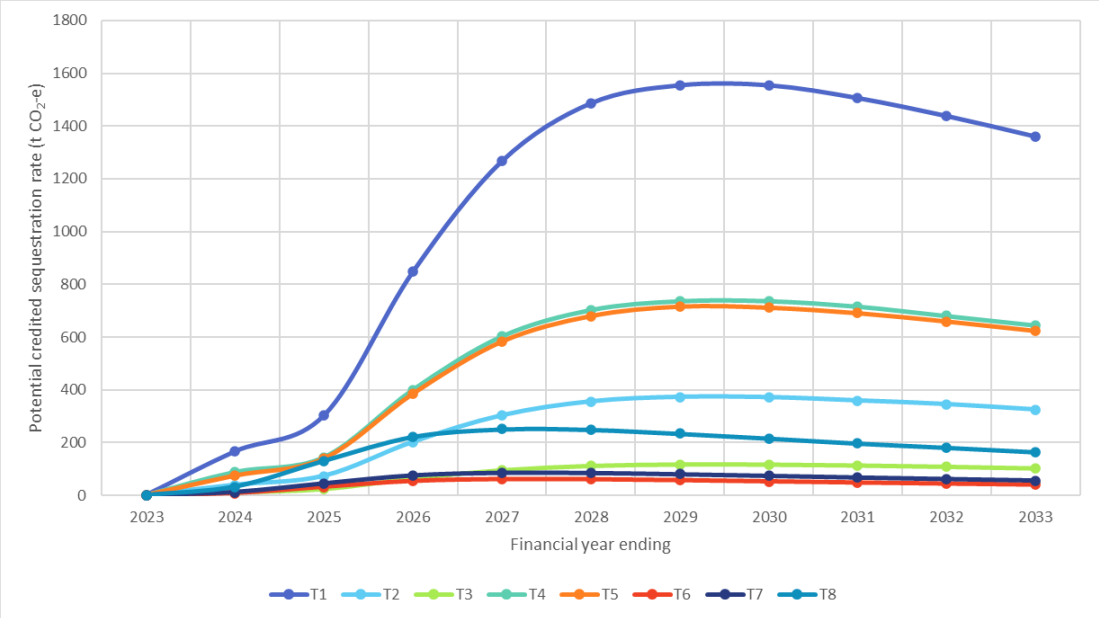

Figure 31. Project sequestration for individual future plots

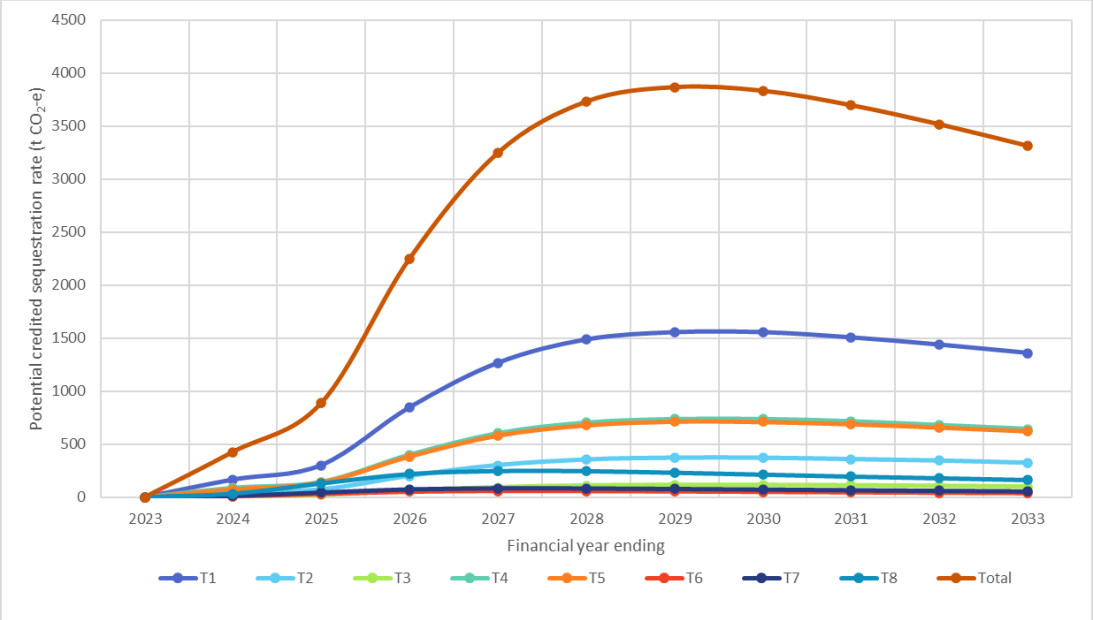

Figure 32. Project sequestration for future plots including total sequestration

4.7. Emission reduction pathway

Assessment of broad range of emission reduction activities and initiatives was completed for Hewitt as part of determining the most appropriate actions and activities both in the direct business and supply chain. This was informed by the supplier workshops where businesses were trained in evaluation of emission reduction and removal activities.

Table 25 provides an outline on the shortlisted strategies.

Table 25. Mitigation shortlist to support pathway implementation

Strategy	Peak abatement by 2035 (net scope 1 & 2 emissions by 2035	Indicative cost	Activities to achieve change
Herd productivity	10.9%	Management and Capital intensive: productivity and asset value benefits expected.	Herd management to reduce numbers of unproductive breeding animals on stations – likely investment, TBC. Development of a new intensive finishing facility with irrigated organic pasture and conventional feedlot – likely investment of $50-150M.
Leucaena pasture	0.6%	Capital intensive: productivity and asset value benefits expected. Lower cost compared to supplements.	Staged planting of 10,000 ha (commenced). Implement a system to account for abatement.
Anti-methanogenic feed supplement	8.3%	High-cost abatement: current est. between $100-400 t CO_2-e.	Implement new supplement feeding through block/water dosing.
Genetic selection for reduced feed intake	2.1%	Cost-neutral if a balanced breeding program can be achieved.	A genetics plan required, in consultation with bull breeders and possible testing.
Genetic selection for reduced methane	2.1%	Unknown. Dependant on the breeding strategy.	A genetics plan required, in consultation with bull breeders.
Solar	0.2%	To be determined.	Continue cost-effective investment.
Flock productivity - sheep	0.5%	Management intensive, productivity and asset value benefits expected.	Pasture improvement, irrigation, flock management for increased meat/wool.
Anti-methanogenic forages	0.1%	Detail pending, may be lower cost compared to supplements.	Selectively plant low methane brassicas/plantain in southern sheep.
Genetic selection for reduced methane	0.1%	Unknown. Dependant on breeding strategy.	Genetic selection for new traits in the sheep flock.
Soil carbon program	2.2%	The cost of compliance may be $15-50 t CO_2-e depending on sequestration rate.	Develop and implement soil carbon projects on 12,000 ha.
Vegetation carbon program (high and low scale implementation)	42% (8.4%)	Pending company-specific costings. 106,000 ha scale. Indicative costs from other projects suggest <$5 t CO_2-e to as high as $100 t CO_2-e with key dependencies related to long-term stocking rate and asset value and risk to abatement from lower yields.	Narwietooma regeneration project registered, pending final approvals from the regulator. Management plan and costing to be developed pending approvals.

The net emission reduction pathway outlined the activities required to deliver substantial emission reduction in the short- to mid-term (to 2035) and has the ambition to align with SBTi FLAG commitments, specifically the 2.4% p.a. emission intensity reduction (commodity pathway, beef). This has not been set as a target for the company at the present stage. For internal purposes and as a result of implementing pathway 2 presented in this report, annualised emission reductions of 19% by 2035 (compared to the 2022 company baseline) were considered achievable (pathway 2, 50% implementation). While these reductions were not linear, the annualised reduction rate was equivalent to 1.6% in this scenario.

Higher net reductions were achieved under the pathway where significant regeneration was achieved. Still, this project has some risks and is likely to remain uncertain, particularly in the next five years (to 2029), while final approvals are developed and early regeneration is established. Additionally, separate from the FLAG-aligned target, the business aims to achieve at least a 0.1% reduction in absolute GHG emissions. The pathways were built from 'the ground up' using a technical assessment approach based on the company's situation and constraints. Both emission reduction and removals were considered.

One substantial removal opportunity was identified – the Narwietooma regeneration project, which could deliver abatement in the order of 42% of 2022 scope 1 and 2 carbon emissions by 2035. However, this project is high risk from a number of perspectives, including the fundamental risk that the project may not regenerate at projected rates or may be at risk because of fire. Regulatory risks also exist with changes in approval and auditing requirements in the ACCU Scheme. Two pathways were developed to manage the impact and risks around the Narwietooma. Pathway 1 included the Narwietooma project at full implementation (with conservative assumptions). Pathway 2 did not rely on Narwietooma but included smaller-scale abatement from regeneration, with projects in the order of 20,000 ha with similar low per-hectare abatement rates as seen at Narwietooma. The pathways are summarised as follows:

Pathway 1 delivered a range in abatement outcomes to 2035 of between 58 and 53% (compared to 2022 scope 1 and 2 baselines), with the range relating to an implementation success rate of 75% or 50% for all other abatement programs. Reductions in emission intensity were equivalent to the total reduction. However, reductions in emission intensity could also be achieved while still expanding beef production through productivity measures, making this a far more flexible target than an absolute reduction target.

Pathway 2 delivered a range in abatement outcomes to 2035 of between 25 and 19% (compared to 2022 scope 1 and 2 baselines), with the range relating to an implementation success rate of 75% or 50% for all other abatement programs. Reductions in emission intensity were equivalent to the total reduction. However, reductions in emission intensity could also be achieved while still expanding beef production through productivity measures, making this a far more flexible target than an absolute reduction target.

Both programs required significant capital investment, operational expense, and management focus and delivered substantial abatement outcomes. The abatement curves were not linear (as shown in Figure 1). On an annualised basis, and taking the more conservative 50% implementation success rate, abatement was 1.6% p.a. (pathway 2, excluding Narwietooma) and 4.4% (pathway 1, including Narwietooma). Both were considered industry-leading and will be less constraining if maintained as emission intensity targets.

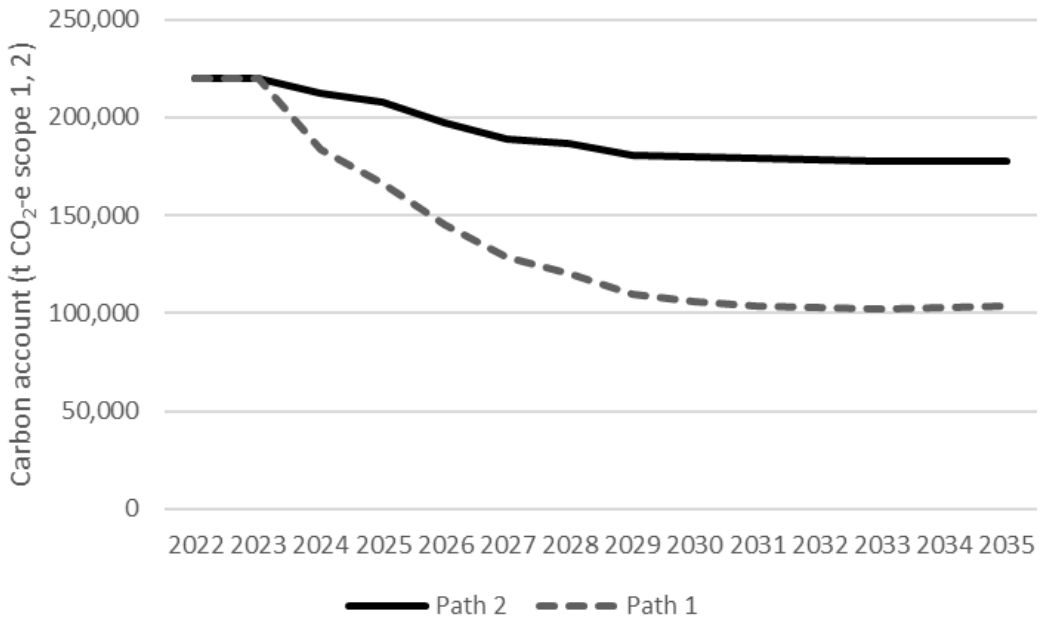

Figure 33. Scope 1 and 2 abatement pathways, showing high regeneration pathway (path 1) and lower regeneration pathway (path 2) scenarios with a 50% implementation rate

4.8. Preliminary climate modelling

To assess the FaIR climate modelling, a range of production scenarios were applied for and compared alongside 'business as usual', approach to investigate the temperature impact of ongoing operations and variations in management practices to reduce impacts:

1. Hewitt numbers stable from 2024 (business as usual).
2. Hewitt numbers increase 3% p.a. year on year until 2050.
3. Hewitt numbers decrease 3% p.a. year on year until 2050.
4. Target to achieve climate neutral by 2035 (10% year on year reduction for the next 10 years – overshoot significantly).

Figure 34 displays the historical and projected warming from 1900 to 2050, and Figure 35 displays the historical and projected warming from 1990 to 2050. Both figures model the impact of the four scenarios listed above. Both figures show the impact of historical increases in methane emissions in the business, which result in ongoing elevated warming into the future compared to 2005 conditions even with significant mitigation activities. With reductions of 3% p.a., warming impacts were expected to return to 2005 levels by close to 2050, noting these scenarios did not include the potential of removals from vegetation as another means of reducing warming impacts.

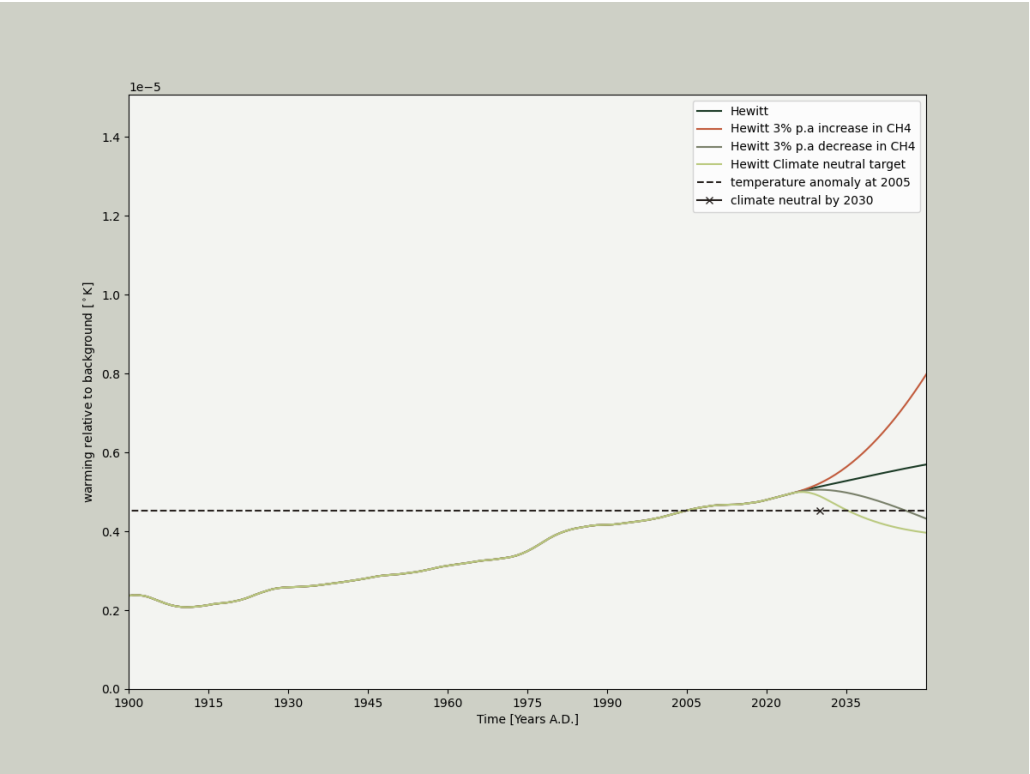
1e−5
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
warming relative to background [°K]
1900
1915
1930
1945
1960
1975
1990
2005
2020
2035
Time [Years A.D.]
Hewitt
Hewitt 3% p.a increase in CH4
Hewitt 3% p.a decrease in CH4
Hewitt Climate neutral target
temperature anomaly at 2005
climate neutral by 2030

Figure 34. Historical and projected warming caused by Hewitt enteric methane emissions (1900 – 2050). Displayed in degrees Celsius (increments of 1 / 100,000th of a degree). Dotted line indicates relative warming in 2005 aligning with the Paris Agreement baseline

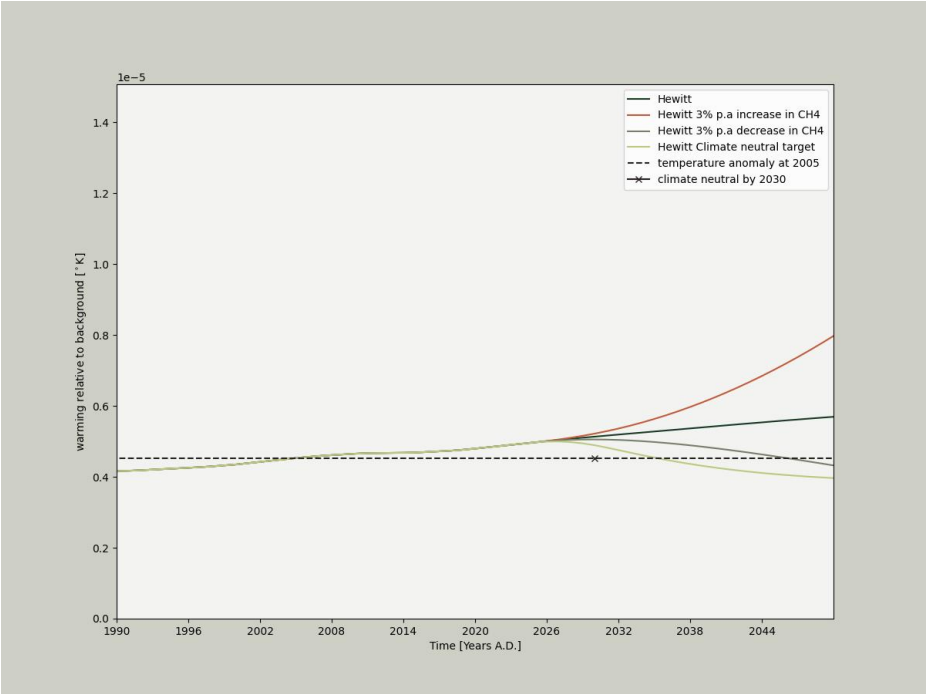

Figure 35. Historical and projected warming caused by Hewitt enteric methane emissions (1990 – 2050). Displayed in degrees Celsius (increments of 1 / 100,000th of a degree). Dotted line indicates relative warming in 2005 aligning with the Paris Agreement baseline

4.9. Supply chain engagement

4.9.1. Carbon workshops

The workshops were delivered primarily to suppliers in grazing regions of QLD and NSW. Most attendees focused on beef cattle grazing. Data collection involved an onboarding meeting, input of production data to an online portal, and one-on-one meetings with project staff to review the data and address questions.

Engagement activities covered a total of:

1. 80 members of the Hewitt team.
2. 169 producers and stakeholders at the annual Hewitt supplier day.
3. 10 large producers (beef and lamb) who were directly engaged by the team with a personalised approach to upskilling in carbon and market requirements.
4. 106 producers who attended the workshops.

The workshops provided a key pathway for engaging suppliers and the wider industry around the process of carbon footprinting, and generated carbon footprint results for several major western regions for the Hewitt supply chain. It also enabled engagement around emission reduction activities and presentation of information on how to move towards lower emission production.

Workshops were held in 10 locations, with a summary of participation provided in Table 27. The average product carbon footprint for beef was 11.8 kg CO_2-e/kg LW, and for sheep, it was 7.5 kg CO_2-e/kg LW. Enterprise production metrics for beef producers were displayed by workshop location in Table 27.

Table 26. Beef producer production metrics by workshop location:

Location	Breeder Herd Size (Avg.)	Land areas (Avg. Ha.)	Breeder Weight (kg. Avg.)	Weaning % Avg.	Lifetime ADG (kg Avg.)	Weight at Turnoff (KG. Avg.)
Roma	607	17,044	555	86%	0.70	551
Clermont	1,025	17,517	511	83%	0.61	487
Moura	1,174	22,177	603	79%	0.70	548
Bedourie	10,548	1,721,200	539	73%	0.63	490
Augathella	1,591	110,333	519	75%	0.75	644

In feedback following the workshop, participants were asked a series of questions about the workshop operation and their intentions. The survey responses were ranked from 1-5, with 1 being 'very unlikely' and 5 being 'very likely'. Findings of broader significance to the industry include the likely rate of continuing to monitor the carbon footprint of their enterprise, for which 56% responded stating 'likely' or 'very likely', while a reasonable proportion were less certain. Notably, responses to supplying data were around half of the participants, so this indicates a larger proportion, at least half of total attendees, could be considered unlikely to participate in carbon footprinting, even if supplied at no cost. Most survey respondents used a computer program for record keeping, which is considered a key enabler for carbon accounting in the future.

Survey Responses:

Question	Response
How likely are you to continue recording and monitoring your product carbon footprint?	7% (1), 7% (2), 30% (3), 19% (4), 37% (5)
Do you use on-farm computer program for records?	59% (Yes), 41% (No)

4.9.2. Soil workshops

Soil Land Food, accompanied by Hewitt, completed:

- Delivery of face to face "Digging Deeper" workshops across the 5 target areas. Participation details are listed in Table 27.
- Delivery of 4 online "Digging Deeper" webinars across the targeted areas. Participation details are listed in Table 28.
- Delivery of wrap up face-to-face "Digging Deeper" workshop across the targeted areas. Participation details are listed in Table 29.

Table 27. Summary of workshop participation

Locality	Number of participants
Moura	14
Springsure	15
Blackall	17
Riverina	19
Broken Hill	15
Total	**80**

Table 28. Summary of webinar participation

Locality	Number of participants
Moura/Springsure	50
Blackall	21
Riverina	38
Broken Hill	26
Total	**135**

Table 29. Summary of workshop 'wrap up' participation

Locality	Number of participants
Moura/Springsure	18
Blackall	8
Riverina	8
Broken Hill	25
Total	**59**

The workshops provided participants with an understanding of soil health management and a targeted action plan to improve the soils on their properties and for their enterprise goals. They are starting to implement practice change.

Participants had the opportunity to complete mapping of their property, describing the indicative land system classification, and to complete soil sampling and receive an agricultural soil analysis report describing the key attributes of their soil (refer Figure 50 in Appendix 2).

4.9.3. Market development

The Hewitt product disclosure statement for Climate Active certification provides an insight into how the certification was assessed for their enterprise:

"The Climate Active certification was selected as it enabled Hewitt Foods to continue to demonstrate their carbon neutral commitment, providing great tasting meat that's ethically raised. Cleaver's beef products are consistent with Cleaver's ethical pillars: Certified Organic, Certified Animal Welfare, and Certified Carbon Neutral. Cleaver's beef is grass fed, free range, and free of genetically modified organisms (GMOs), antibiotics, added hormones, synthetic chemicals, and artificial preservatives, colours and flavours."

Hewitt elected to certify products produced through their beef, lamb, pork and chicken supply chains.

5. Discussion

5.1. Carbon baseline

5.1.1. Scope 1 & 2

This study developed a detailed scope 1 and 2 carbon account covering all emission sources with Australian methods. The primary contributor to the business GHG account was livestock emissions, which was expected.

Hewitt provided details of historical carbon account analysis that had been completed for CY 2020 and CY 2021. Figure 36 displays scope 1 & 2 GHG emissions for beef and sheep increasing from 141,004 t CO_2-e in CY 2020 to 214,190 t CO_2-e in CY23. While some method differences existed between the 2020/2021 and 2022/2023 analyses, the primary contributor to this increase was business expansion and particularly the growth in Hewitt cattle herd and sheep flock, with the purchases of Narwietooma and associated herd and the southern NSW stations including Tubbo station in this time. The current business has what would be considered a significant carbon account, principally because of livestock enteric methane (Table 34) which combined with other direct livestock emissions was consistently in the order of 93% of emissions.

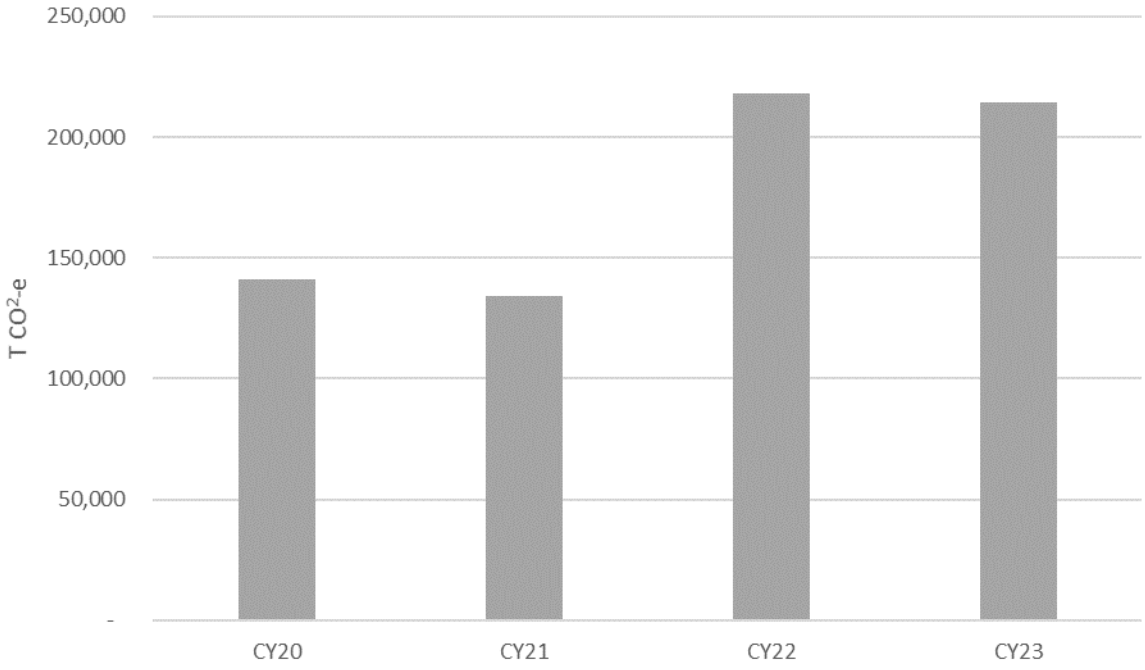

Figure 36. Scope 1 & 2 GHG inventory – Beef & Sheep (excl. LU, dLUC)

Table 30. Emission contribution by gas (excl. LU, dLUC)

Source		CY20	CY21	CY22	CY23
Enteric Grazing	CH_4	93.0%	92.9%	93.3%	92.9%
Methane Manure	CH_4	1.1%	1.1%	1.4%	1.4%
Nitrous oxide from manure	N_2O	3.5%	3.5%	3.6%	3.6%

Nitrous oxide - indirect	N_2O	0.4%	0.4%	0.4%	0.4%
Services	CO_2	2.0%	2.1%	1.3%	1.7%
Total		100%	100%	100%	100%

5.1.2. LULUC impacts

Emissions accounting was expanded to include LULUC impacts associated with changes in vegetation and soil across the properties in 2023. Emissions and removals from LU and dLUC sources remain less certain and subject to unclear guidelines. Noting the high level of uncertainty, analysis is ongoing to improve certainty and provide results that can be reported publicly.

5.1.3. Scope 3 emissions

Hewitt reported scope 3 emissions for the first time as part of this project in 2022, and repeated and expanded on this assessment in 2023. The assessments were prepared to provide a more complete assessment of the business impacts and to support future reporting requirements. Scope 3 assessment can require large data collection requirements, but in livestock exposed businesses the most material impacts are associated with purchased livestock or meat. Accordingly, this was the initial focus and the analysis was expanded in the second year to include all categories. Expansion of the assessment resulted in 6% additional emissions in 2023, suggesting a small under-estimate in the 2022 results. Overall, scope 3 emissions declined by 52% between CY 2022 and CY2023 (see Figure 37).

This is

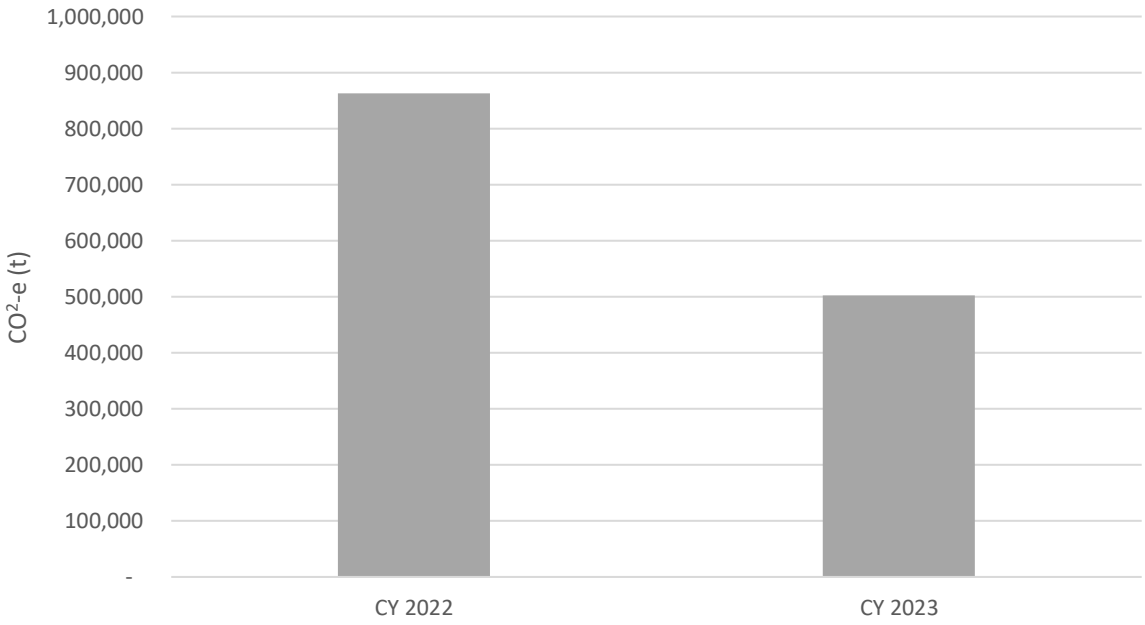

Figure 37. Scope 3 GHG inventory for 2022 and 2023

During CY 2022 the livestock acquisition associated with the purchase of Narwietooma resulted in an allocation of 239,807 t CO_2-e in emissions associated with the “once off” purchase of livestock which was the primary reason for the emissions decreasing substantially in 2023, when no equivalent purchases were made.

Within the CY 2022 assessment period Hewitt also purchased higher volumes of boxed beef from 3rd parties than in CY2023, which resulted in 299,084 t CO_2-e of emissions which was greater than the sum of boxed beef purchases in CY2023.

Scope 3 emissions relating to the purchase of beef cattle over-the-hooks (as HSCW) was a major contributor across both periods, contributing approx. 250,000t CO_2-e to the scope 3 inventory within each period.

The scope 3 emission assessment did not include LULUC emissions, for which there were no regional values that could be used, and no supplier data. This was potentially a substantial gap in the analysis though at present, the magnitude is uncertain.

5.1.4. Product carbon footprint

The carbon footprint (kg CO_2-e kg LW^{-1}) for Hewitt cattle ranged from 16.0 to 17.2 kg CO_2-e over the two years of assessment, which was higher than the national average for slaughter cattle in the ABSF, which was 13.1 kg CO_2-e kg LW $sold^{-1}$. This national average is inclusive of higher growth rate cattle from southern herds, and feedlot cattle, and is reduced through inclusion of cattle from higher rainfall areas where weaning rates are higher and mortality rates are lower. These factors largely explained the difference. This relatively higher carbon footprint indicated there was some potential to improve performance by increasing breeder herd efficiency (weaning rates, cull cow turnoff rates, mortality rates) and by increasing young cattle growth rates.

The CF for young cattle supplied to Hewitt Foods was 12.6 kg CO_2-e kg LW, inclusive of supply from 3rd parties. The lower result compared to the Hewitt property average was driven by differences in the class of cattle supplied to the meat business and analysis of the young cattle, excluding cull cows and bulls. The young cattle had improved weight gain and efficiency through the supply chain in contrast to the company average which included all sales (cull, feeders included), and a higher allocation of scope 3 emissions due to more comprehensive data availability.

As described within Section 4.2.2 and displayed within Figure 38 analysis of supply chain production results demonstrate the strong influence that age and weight of an animal has on the product carbon footprint. This showed significant variation in performance, from a peak of close to 17 kg CO_2-e to a minimum of 9.8 kg CO_2-e, suggesting there was significant room to improve performance by increasing weight for age and drawing cattle from higher productivity herds. This variation supports the estimate that herd productivity could reduce emissions by 10.9% (Table 25).

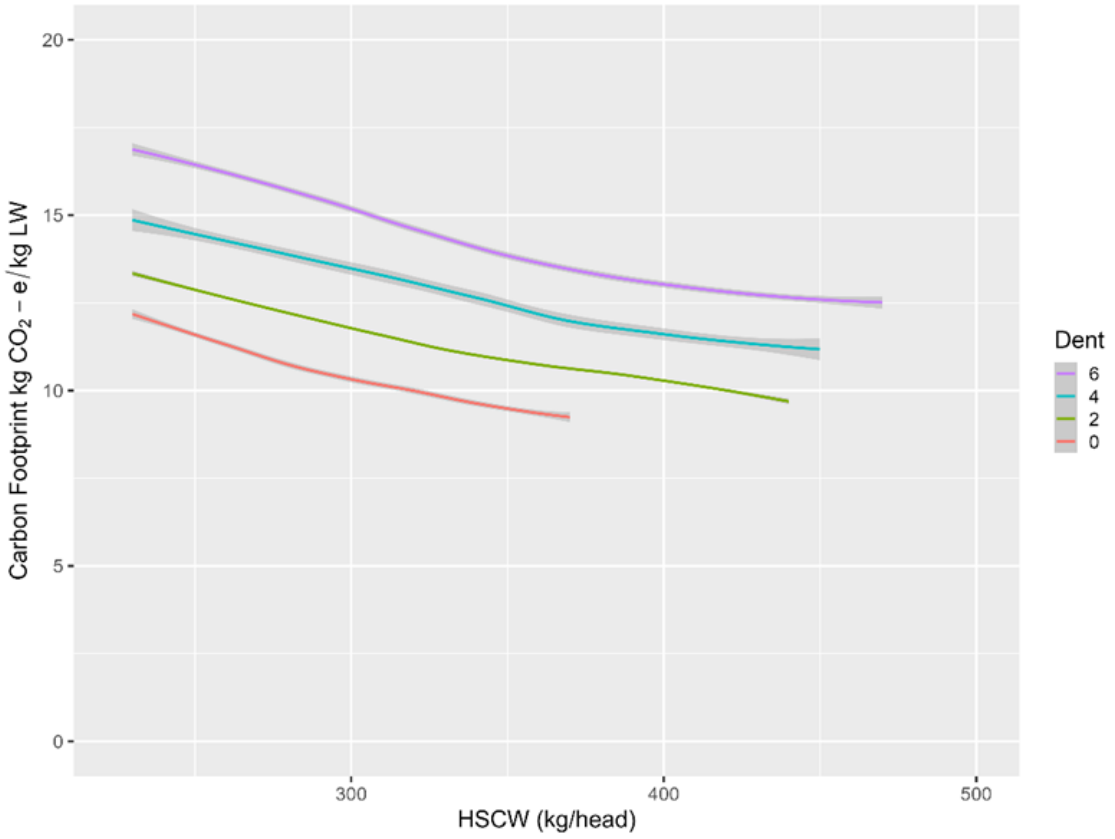

Figure 38. Relationship between product carbon footprint, HSCW and dentition in cattle sourced for Hewitt Foods brands

5.2. Emission reduction plan including insetting options

Hewitt Agribusiness has a large carbon account driven by scope 1 emissions from the livestock enterprise and scope 3 emissions from both the livestock enterprise and the meat business. The company have a high-level ambition to be net zero by 2050, in line with global goals. Total scope 1, 2 and 3 carbon accounts exceeded 1 M t CO_2-e in 2022 and was slightly moderated to 781,000 t CO_2-e in 2023. This placed Hewitt Foods into the class of a high emission business with significant exposure to scope 3 emissions.

The net emission reduction pathways were developed to deliver substantial emission reduction in the short-mid term (to 2035) with a general goal of reaching ambitious reduction goals (SBTi FLAG), which require emission intensity reductions of 2.4% p.a. for the beef commodity pathway.

The pathway was developed assuming the 2022 carbon account remained relatively stable over the forward estimates to 2035. Reduction rates were determined from a detailed assessment of technical mitigation potential. They assumed implementation of between 75% and 50% for scope 1 and 2 emissions reduction and between 50% and 25% of scope 3 emissions from Hewitt Foods.

Two areas of uncertainty exist with the stated plans. Firstly, the ability of the central Australian properties to deliver removals, given uncertainties related to long-term climate and risks from fire, is a risk to overall delivery of abatement considering these potentially supply high volumes of removals for the pathway.

The second area of uncertainty relates to required methane reductions and how these are handled in emission reduction plans for methane exposed businesses. A strong, science-based position exists for a different and lower reduction target for methane compared to CO_2. The current plan has not established a separate methane target because Australian policy currently has a 'bundled gas' approach where methane is treated the same as CO_2 from an emission reduction perspective. Further, globally accepted programs such as the Science Based Targets initiative (SBTi) don't yet recognise the lower methane reduction target requirements. However, reconsideration of the need for methane reduction could result in less overall requirement for abatement, and this would materially change the abatement needed for the company to contribute to international temperature outcomes. Methane reduction rates of between 0.3% and 1% p.a., may be acceptable under Paris-aligned net zero plans, when combined with net zero CO_2 and nitrous oxide, by 2050.

Vegetation sequestration options were limited because of the lack of insetting methods. ACCU scheme projects, while available and reasonably suited to the production system, are relatively high-cost to implement which created a significant implementation barrier. Further research is urgently needed to develop an “insetting” method for removals from native vegetation regeneration, tree planting and soil carbon sequestration.

Methods and systems are also needed that enable smaller producers to offset emissions at reasonable cost for compliance, and this is a key, ongoing need.

While costings were not formally undertaken for the emission reduction program, the company has focused on the most prospective and lowest cost options to implement, which were the regeneration project and herd improvement strategies to reduce product carbon footprint. Prospective options may also exist to build soil carbon, but limitations in the current measurement of soil carbon increases at scale in moderate rainfall regions were such that it was difficult to justify an ACCU Scheme project, even when supported by high-reliability strategies such as Leucaena pasture development on previously cropped, basalt soils.

One upshot of the emission reduction plan was establishing projects that could be co-funded by meat customers. While premiums appear more difficult to establish in the marketplace, partnerships around emission reduction are a major area of development and the plan has established options to progress abatement through co-funded activities.

5.3. Natural capital and biodiversity baseline

5.3.1. Natural capital

When considering the results of the asset materiality assessment overlaid against relative productive value (measured in terms of Hewitt’s current nominated carrying capacities) interesting insights arise.

Whilst Warilba and Brewarrana were noted for their high productive values, they were also some of the lowest tiered stations from an assessed natural values perspective (proportion of property represented by tier 1 assets). On the other end of the scale both Yorkshire and Coolreagh have modest relative productive value but a higher proportion of natural values.

There is a cluster of stations which support a balance of productive and natural values. These include Oakwood, Pony Hills, Bylong and Packsaddle. Being able to categorise where each station sites on this

scale has a potentially significant impact on future investment and management decisions. Figure 39 provides a summary of productive vs natural value values of all stations within scope.

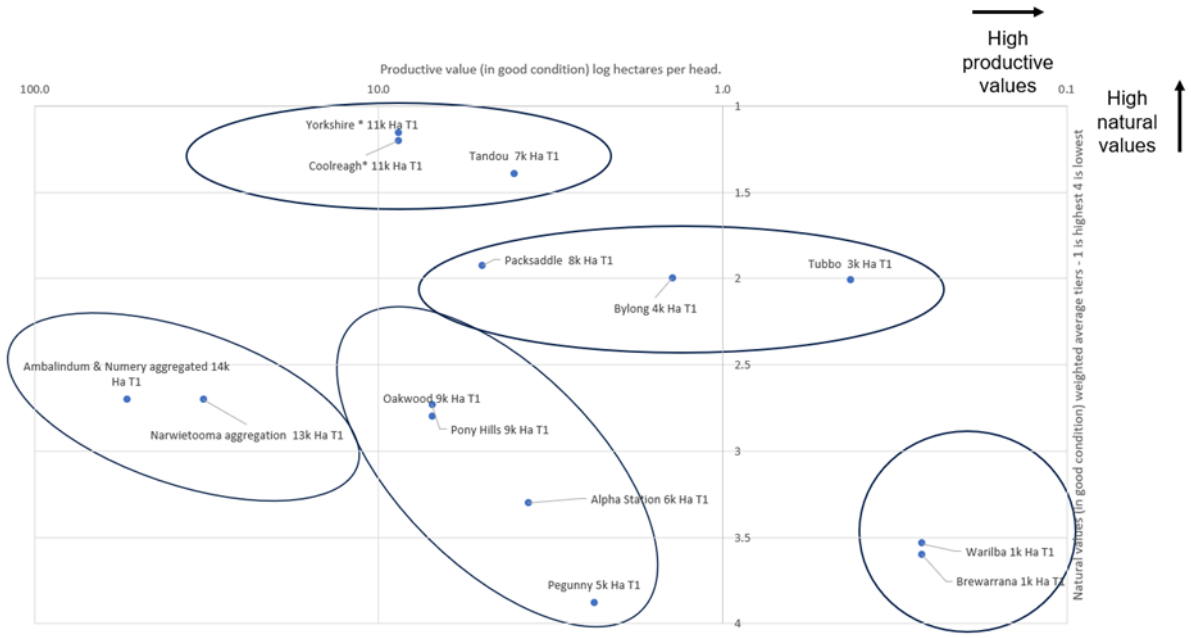

Figure 39. Natural vs productive values of assessed stations

The assessed portfolio was found to be home to a number of high value natural assets with eight sites of national significance located within the Northern Territory. A further eight threatened Ecological Communities were identified across the Hewitt portfolio including Mitchell Grass, Brigalow, and Weeping Myall Woodlands. Birds Nest Wattle (Acacia pickardii) is a particularly rare tree species and was located on one of Hewitt's stations in the Northern Territory.

Extending beyond flora, Hewitt's portfolio was found to also be home to a number of significant fauna species. Through targeted surveys, Bush Heritage confirmed presence of four threatened fauna species on Hewitt properties: the Critically Endangered Central Rock-rat (*Zyzomys pedunculatus*), and Vulnerable Black-footed Rock Wallaby (*Petrogale lateralis*), Julia Creek Dunnart (*Sminthopsis douglasi*) and the Great Desert Skink (*Egernia kintorei*).

The Central Rock Rat was once thought to be extinct but was rediscovered in 1996. This medium-sized rodent is confined to the arid areas in Central Australia. It has experienced significant declines in number and range due primarily to the ongoing threats of feral cat predation and wildfires. It is estimated that only around 650 individuals remain in the wild and at the current rate the species is highly susceptible to extinction in the next twenty years.

To assist in protecting this species Hewitt could consider targeted fire management to limit or help prevent high intensity wildfires within their known habitat ranges. Additional targeted baiting of feral cats particularly after high rainfall periods is highly recommended. Finally, consideration could be given to predator-free sites where feasible to provide protection to a core group whilst broader landscape scale actions (fire & predator control) are implemented.

Other fauna species of note either observed or known to inhabit Hewitt's assessed properties can be viewed within Figure 40

Figure 40. significant flora and fauna inhabiting the stations within scope

Management actions

Whilst the assessed stations were found to contain diverse and important productive and natural values there were common threats to these values that extended across vast parts of the portfolio. Table 31 details observed material threats to the portfolio's natural and productive values as well as suggested management actions to assist in protecting and enhancing these values.

Table 31. Key identified threats to natural and productive values

Threat	Resultant management actions/considerations
High grazing pressure	• Overgrazing can lead to sub-optimal ground layer conditions. The ground cover can become a monoculture, weedy and/or increaser species (eg Sclerolaena spp) dominated. This risk is greater during droughts. Maintaining minimum pasture heights in paddocks can reduce the risk of overgrazing • Grazing pressure is impacting native woodland ecosystems by reducing diversity in the herbaceous layer and restricting natural succession of shrub and canopy species • Stock exclusion/reduction in remnant ecosystems would reduce the impact on woodland ecosystems and reduce the establishment of introduced species such as Buffel grass. Fencing could also be used to create wildlife corridors between isolated patches. • Minimising overgrazing will help maintain the remaining areas of native grass and groundcover, thereby reducing the ability for Buffel grass to dominate • Spinifex dune systems were found to be relatively intact and unlikely to support many cattle (because most species in this system are unpalatable). They are also very fragile. Minimal to no stocking of these areas is recommended. On the Ambalindum Aggregation in the area around Sinkhole bore, cattle remain because it is the only available water within the area. Due to the limited accessibility of palatable grasses, the dune swales and small blue mallee patches are being disproportionately negatively impacted. A review of grazing impacts within this area is recommended.
Presence of weeds	• Consider resting sections of land from grazing for longer periods so the long-lived native perennial grasses (such as Astrebla) can regain dominance over the weedy species and annuals • Buffel grass is particularly problematic when not grazed at all, as it can outcompete native species in favorable habitats (e.g. lighter texture alluvial soils, calcareous areas). It is recommended that this species is not deliberately spread into areas where it is not currently found or is only sporadic. The conversion from diverse lower, mid and canopy layers to a monoculture of Buffel grass will not assist with the creation and deposition of nutrients required to maintain a viable pasture for the longer term. • From a biodiversity perspective, Buffel grass fields, particularly when blade ploughed, provide little to no habitat or food sources for native species.

	This is reflected in the observed lack of ground storey grassland species (such as quail and bushlarks) across some stations. • As an increaser species (increasing fuel load), Buffel grass has the potential to result in higher intensity wildfires posing a risk to station infrastructure, stock feed reserves, biodiversity and overall land condition. Tree and shrub death are of particular concern in such intense fire events. Areas with high fuel loads (particularly the areas of Buffel grass monocultures such as Quartz Hill) need to be managed delicately • Introduced African Lovegrass Eragrostis cylindriflora was noticed along the windrows of some roads. This species has the potential to take over native pastures and is not palatable to cattle. Care should be taken to reduce the further spread of this species with earthmoving or other equipment.
Vegetation clearing	• Allowing areas of Brigalow regrowth to establish would be a positive step towards returning this nationally endangered ecosystem to health on certain properties. Given appropriate stock exclusion/minimisation and management, this change would improve on-farm biodiversity and may be assessable for existing carbon markets. With appropriate planning, regrowth areas could be used as wildlife corridors to increase habitat connectivity between forest areas whilst potentially doubling as shelter belts for livestock. By allowing regrowth to mature, these areas would form a habitat with considerable flora diversity, and ecosystem function would improve with time. • Some areas of non-remnant Brigalow and vine thickets are being cleared on occasion to maintain grasslands. However, inspection of the tree/shrub regrowth shows a high diversity of flora species, similar to nearby remnant areas justifying a reason to review this clearing practice. • A reduction in tree clearing has the potential to reduce local evaporative demand stresses on grass species and thus support greater moisture retention particularly in dry periods.
Erosion	• Consider strategic planting measures to stabilise current eroded areas and limit stock access particularly within vulnerable riparian zones • Investigate landscape interventions to manage overland flows and appropriately restore hydrological function • Gully erosion is well established in some locations. Under current practices this will continue to expand, further degrading grassland ecosystems, contributing to siltation of creeks and reducing grazing area • Some roads and fence lines have no erosion control measures which will in the longer-term cause increased erosion
Fire	• Whilst fire is an important tool for hazard reduction it can also be important for pasture and forest management. Occasional burning of various ecosystems, in line with Qld Herbarium Fire Management Guidelines, is recommended for sustained health of local fauna and flora populations. More frequent burning is likely to reduce habitat value and promote invasive species, such as feral cats and Buffel grass

Feral animals	• Fencing off and removing cattle from woodland has the potential to promote more groundcover off the road corridors, providing shelter for wildlife and protection against feral cat and fox predation. • Camels readily cause damage to fences and other infrastructure in addition to environmental impacts; control should be coordinated on a landscape scale where possible.

Throughout the project Bush Heritage worked closely with Hewitt to develop conservation initiatives to complement on-farm production. The key initiatives included targeted engagement with Hewitt executive staff, development and socialisation of Station Posters and the designation of future Impact Projects.

The key intent of the station posters was to summarise the key natural values present or likely to be present on each station. These concise yet powerful single page documents provide on ground operational staff with key knowledge around what flora and fauna communities exist, which are significant and which of those are at risk. The aim of this engagement was to help manage the various land types in a way that maintains or improves their ecosystem value aligned to Hewitt's vision to become the world's most sustainable meat producer. Figure 41provides an example of a completed Station Poster.

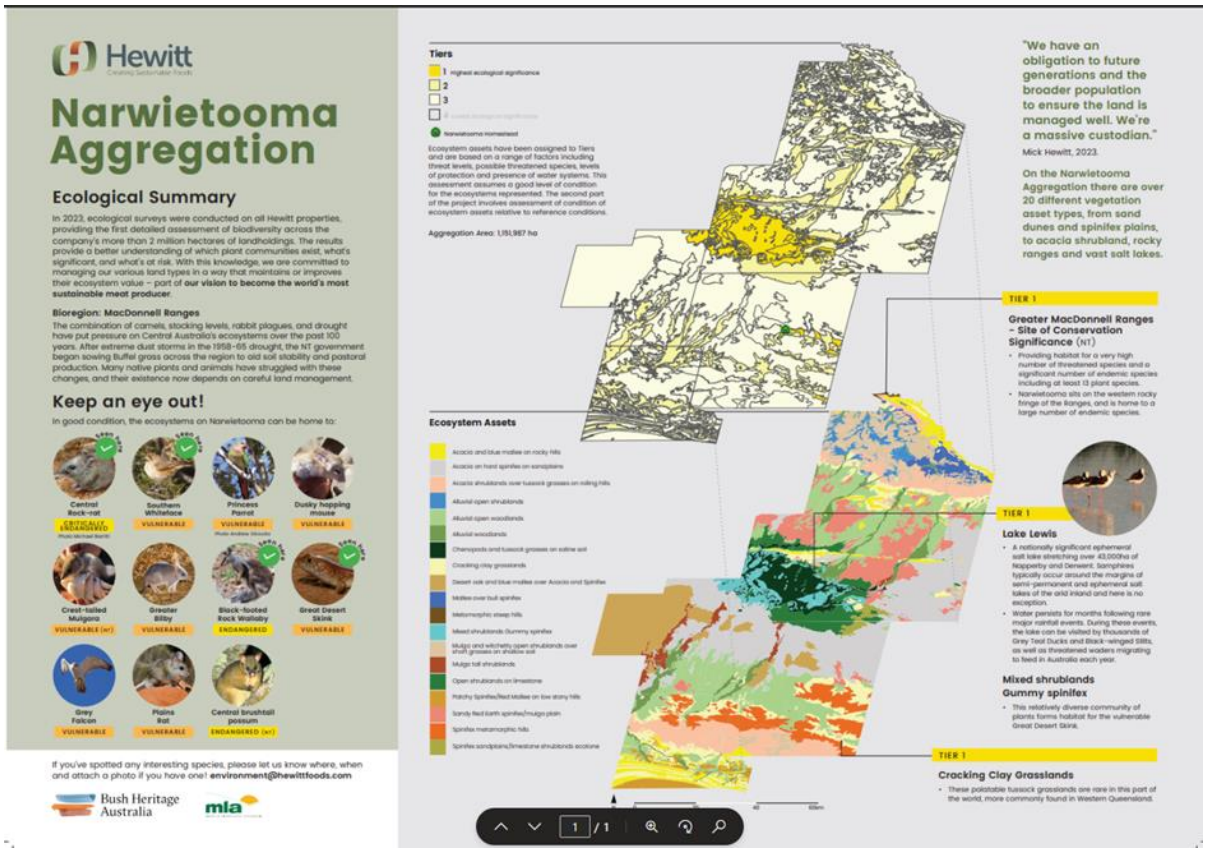

Figure 41. Narwietooma Aggregation Station Poster

Further to Station posters, Bush Heritage and Hewitt worked collaboratively to develop a list of potential future Impact Projects. Impact Projects are those which have a defined purpose and seek to drive positive management actions through conservation, stewardship, transformation or regeneration. The identified Impact Projects vary in size and complexity. Table 32 provides a summary of key Impact Projects as well as the anticipated risk if not actioned.

Table 32. Identified Impact Projects to improve natural and productive values

			Risk of no action		
Impact Project	**Description**	**Impact type**	**Regulatory**	**Reputational**	**Operational**
Forage budgeting	Development of standing dry matter targets post dry season to enable development of processes and disciplines to achieve production and conservation outcomes	Stewardship	Low	High	High
Reference areas	Establishment of reference areas to assist in biodiversity assessment and reporting. Develop matrix by vegetation type of required reference site characteristics (eg size and buffering considerations).	Conservation	Med	High	Med
Conservation areas (sites of significance or tier 1 assets)	Identification of conservation areas with high to very high natural values and relatively low productive values. Development of conservation plans.	Conservation	Med	High	Low

High grazing area impact review	Targeted identification of areas observed to have high grazing impacts (observed in ground layer or tree recruitment). Consideration of management options (eg spelling / exclusion). Use field data and post survey feedback forms.	Regeneration	Low	High	Med
Tactical management feedback	Selection of tactical feedback from field visits to be shared with stations. Note to be differentiated from strategic Impact Projects included in this list to limit confusion and maximise impact from larger projects in line with ability to fund/support	Conservation	Med	Med	Med
Feral animal - landscape pilot	Establishment of prioritised feral animal management programs for landscape implementation	Conservation	Low	High	Low
Brigalow Restoration Pilot	Pilot in Brigalow region to restore natural values, build resilience and potentially carbon income	Transformation	Low	Med	Med
Fauna surveys	Targeted fauna surveys to prioritise further work to establish natural values on Hewitt properties	Conservation	Low	High	Low

Fire pilot	Development of a proactive fire management pilot which evolves a reactive/prevention approach to a proactive optimisation approach	Regeneration	Low	Low	Low

Hewitt have established a strong baseline biodiversity database (Environmental Accounts) across their assets. This creditable baseline forms a strong foundation for measuring, monitoring and reporting on changes over time. Further, the maintenance of the established AfN Environmental Accounts supports Hewitt's ESG Pathways for a Vertically integrated Organic Supply Chain. The objective of which is to demonstrate how combined ESG actions (Carbon, natural capital and regenerative agriculture) can be successfully implemented and monetised within red meat supply chains**.**

This project has involved substantial activity and innovation with Hewitt now well placed both to establish market leading reporting structures for it's sustainability agenda and also inform management plans and actions to protect and enhance biodiversity and natural capital. Key challenges relate to:

- Future monitoring requirements given the likelihood of undertaking such an extensive study is low within typical budgets
- Setting realistic biodiversity goals that interact positively with production
- Identifying the most cost-effective management activities that protect key biodiversity assets and enhance their habitats.

5.3.2. Natural capital supply chain pilot

The market exposure risk assessment revealed that GHG emissions and deforestation are key concerns for Hewitt stakeholders. As a result, it is expected that national and international policies and standards will shape market access and requirements for industries in the coming years. Additionally, regenerative agriculture, with its emphasis on sustainable and nature-positive practices, has also emerged as a key focus area for national and international stakeholders. Hewitt is well-positioned to navigate this market shift, having proactively certified most of their portfolio properties and suppliers through the Regenerative Organic Certified (ROC) process. However, it is recognised that quantitative assessment is a growing expectation to support market claims, and single-issues such as deforestation assessment largely necessitate this shift towards quantitative assessment. This poses a potential risk for beef brands, but also an opportunity if high quality, quantitative assessments can demonstrate a high standard of land management.

The quantitative results for the assets assessed for the Hewitt portfolio suggests:

- the weighted average scores for the assets assessed for the Hewitt portfolio properties are skewed towards the Narwietooma Aggregation (54% of combined area) and Ambalindum (27% of combined area).

- Forage / Soil condition is similar for all the properties except for Pony Hills (26%) and Tandou (68%). Without the consideration of other factors, this suggests that Pony Hills was grazed heavier than the surrounding areas, while Tandou had more sustainable grazing.
- Forest cover extent ranges from 0.24% for Julia Creek Aggregation, to 49% for Pony Hills. This is likely more a reflection of each property's biogeographic region but should be assessed individually by considering the comparative score, management history and specific circumstances of a property.
- Forest based pasture benefit is between 63% and 81% for all portfolio properties, except for Pony Hills with 51%. The lower score for Pony Hills is reflective of its higher forest cover extent score, suggesting that there is less available pasture on the property for grazing.
- Forest connectivity ranges from 45% on Julia Creek Aggregation to 94% on Pony Hills. These values are reflective of the forest cover extent on each property but can also point to past management decisions. The scores should be considered based on the specific conditions of each property and in the context of the management direction of the property.
- The riparian forest extent ranges from under 2% for Julia Creek Aggregation, to 55% for Pony Hills. This again seems to be more of a reflection of each properties forest cover extent but should still be evaluated by considering the management history and policy in place to project riparian vegetation.
- General habitat condition scores range between 38% to 53% for each portfolio property, suggesting that most properties habitat condition has stayed relatively stable over the 10-year period that it was estimated. The one exception is Tandou, where the 8% score suggest that there has been a decline in habitat condition over this period. The ECond scores provided are a different type of data and do not represent change but instead represent current condition – Econd / LOOC-B data comparison will be possible following another round of AfN assessment.
- The significant species habitat condition scores vary from 1% for Oakwood and Tandou, which suggests a decline in habitat condition, to 83% for Bylong, which conversely suggests there has been an improvement in habitat condition. For both general and significant species habitat condition, it is important to consider that the specific circumstances and management actions match results (e.g. does Bylong have significant regrowth occurring?).

Qualitative assessment of risk for many assets for the Hewitt estate is strongly linked to location, and thus climatic conditions:

- the properties in north have an elevated fire risk.
- pest species risk is more prevalent in coastal areas.
- water availability is generally a high risk, but is then managed adequately by Hewitt's processes.

The results of quantified assessments for the Hewitt supplier property clusters were confidential.

Natural capital management will become an increasingly important part of asset management for major landholders.

- Because of new expectations from customers and investors, these tools can provide opportunities for risk management and effective land management. Fundamentally, poor management of soils and pastures will result in long-term decline in asset value, though this can take a long-time to translate to tangible declines such as a reduction in stocking rate. A

more detailed understanding of soil and pasture management may also open doors for value creation in areas where soil carbon levels can be increased.

- Vegetation management is both a risk-management consideration, and potentially a new asset class through carbon markets. Mooted biodiversity markets may also be value generating pathways. While biodiversity credits are an emerging space, it is likely to be a high-value aspect to land management in the mid-term future. The first use-case for this reporting will be built around these fundamentals of sound land asset management and this can be enhanced over time by adding new assessment areas and training in how to improve outcomes.
- Further to this advantage, the NCA provides a new level of robustness by adopting spatial mapping, which augments and enhances the current systems such as ROC which are more strongly based on evaluation against management practices using administrative audits, rather than impacts *per se*.
- In the near future, we expect most assessment programs based on administrative audits will augment these with spatial assessment to increase the power of the analysis provided and to deliver new requirements such as reporting against deforestation free commitments. In this respect, the system provides a level of future proofing and a very high standard of reporting and verification for the supply chain.
- Opportunities may exist by using this system to provide credentials for new production systems that are not limited to organic status, such as the 'natural grain' program under consideration. We believe the assessment standard here could be used to underpin such a program with further development and testing in the market with customers.
- A further application is to support access to finance. High standards for managing natural capital and deforestation risks are increasingly part of funding approvals and this system should deliver value for participants by meeting these requirements.

5.3.3. Deforestation

Deforestation emerged as an important market access challenge during the course of the project and was added to the scope of works to address the needs of the company and supply chain. Future work needs to be done to fully outline the methods and requirements for assessment and the implementation of these in the Australian context. There are likely to be several deforestation definitions and assessments, and clarity both in the interpretation and implementation will be needed for supply chains to be able to engage with customers on these requirements in the future.

5.4. Supply chain engagement

5.4.1. Carbon and soil workshops

The carbon workshops were delayed compared to the initially planned roll-out mainly to avoid the shocks in the cattle and sheep market that occurred in the second half of 2024. It was noticeably more difficult to engage producers in the workshops than had been the case in other projects delivered by Integrity Ag in 2022 and 2023. While reasons were not definitive, it was possible that a proportion of interested producers had already attended similar events, or a that the interest in carbon was declining. It was speculated that attendance decreased after changes to carbon markets,

such as the removal of the Human Induced Regeneration (HIR) method, which has been popular in regions where the workshops were held.

These various factors contributed to a more difficult environment to engage producers on the topic of carbon. This feedback was important for Hewitt, which is receiving market signals from customers to engage the supply chain in emission assessment and reduction and to consider deforestation and other natural capital related issues. In an environment where premiums are being achieved for Organic certification, but not for “low carbon” at this stage, this sets up a more difficult environment for beef brands.

5.4.2. Market development

Hewitt successfully completed the registration process for products within the Climate Active program. The value directly associated with this certification is difficult to quantify, but Hewitt indicate that is does provide surety to some customers and stakeholders to know that the products are certified through an independent and audited verification program.

The program also underpinned the organic and regenerative labelling already used for the brand, through verification of nature impacts and carbon emissions. Further marketing options continue to be explored.

Figure 42. Hewitt brand “Cleavers Organic” with associated Climate Active logo displayed

Figure 43. Hewitt brand "Cleavers Organic" with associated Climate Active logo displayed

6. Conclusions

6.1. Key findings

This project has demonstrated application of a large-scale carbon account, which used methods consistent with those required by future regulations such as the Climate Related Financial Disclosures regulation. Further, product carbon footprints were determined for both the production system, and for the meat supply chain. Interestingly, because of product procurement specifications and buying patterns, impacts reported for the supply chain tended to be lower than impacts from the Hewitt properties, indicating differentiation exists between carbon footprints depending on the system being evaluated. In the case of the properties, the carbon footprints represented the aggregate of all cattle "products" or sale types from the operation, which included prime cattle sent for processing, cull cattle and feeder cattle. Typically the better types of young cattle were sold into the company meat supply chain resulting in lower carbon footprints as a result of the higher weight-for-age from these cattle compared to the company average.

Emissions and removals from LU and dLUC sources remain less certain and subject to unclear guidelines. Noting the high level of uncertainty, analysis is ongoing to improve certainty and provide results that can be reported publicly. An emission reduction plan was established and some opportunities were explored for early stage implementation within the duration of the project. Emission reduction is expected to be a long-term program for the business, considering the scale and nature of the emission sources.

During the course of the project, expectations from the companies' investors, and some markets, have moderated, and the company focus both at the operational and market level is focused on delivering ongoing net emission reductions into the future. The actual rate of reduction will become clearer over the coming five years as the first major projects are implemented.

Preliminary climate modelling of temperature impacts (as opposed to changes in emissions only) showed that historical increases in methane, as a result of increased herd numbers, had resulted in increased warming as a result of company operations compared to a 2005 temperature baseline (set to align with the Paris Agreement). Substantial reductions in methane were required to reduce the temperature impact to 2005 levels by 2050. However, this modelling was limited to changes in methane, not the complete carbon account, and future modelling should include both the full historical emission profile and the full range of mitigation options, including vegetation and soil removals.

The project aimed to engage suppliers to the Hewitt Foods meat supply chain. This was carried out through information workshops on soil health and carbon emissions and reduction options. A large number of supplier carbon footprints were completed, which enabled accurate modelling of supply chain emissions, providing confidence for market claims regarding the carbon footprint of products. The analysis revealed substantial variation in the carbon footprint of beef sourced for the meat supply chain, suggesting improvements could be achieved through selecting lower emission cattle, specifically those with higher growth rates, sourced from herds with better breeding performance. It is noted that these factors are impacted by season which may also result in increased emissions in some lower rainfall years. None the less, it was considered reasonable to target reductions of 10-11% through productivity measures over the next 10 years.

Engagement with suppliers to provide carbon footprint data was challenging, with few suppliers seeing a clear benefit to engagement. Larger, frequent suppliers recognised that carbon footprint data

has become a 'market access' requirement, though to date there is no further price incentive to provide data or reduce emissions. This is likely to become a more challenging aspect of the cattle market for Hewitt and other suppliers into the future, until market signals emerge. A new method was established to reduce the barriers for providing the carbon footprint of cattle purchases, through establishment and calibration of a bespoke supply chain model for the company. This model will enable verifiable carbon footprint prediction of supplier cattle into the future with reduced data requirements and higher accuracy.

While this barrier was reduced, achieving emission reductions in the supply chain will be challenging until lower cost options can be established and supply chain partnerships emerge that can share implementation costs. The project has established several opportunities for future funding of emission reduction with supply chain and other partners. The success of these projects will be highly influential on scope 3 emission reduction in the next 5 years and beyond.

Opportunities exist in both the Hewitt operation and the supply chain for lower cost emission reduction using pastures such as Leucaena and Desmanthus, and potentially through regeneration of forest or shrub land. These opportunities are currently severely hampered by the lack of cost-effective verification methods and addressing this problem is a key finding for the project. It is difficult to see significant advances in abatement within the next 10 years without these methods being developed.

Natural Capital (Biodiversity) Assessment

The Natural Capital (Biodiversity) assessment undertaken by BHT provided a method for categorising and baselining broad habitat type condition, as well as identifying significant environmental assets such as species and vegetation communities protected under Commonwealth legislation. The repeatability of this assessment however is problematic given the cost, and the most practical use of such an assessment may be a one-off baseline.

Natural Capital Supply Chain Assessment

The findings of the market exposure assessment suggest that the most important current and emerging sustainability drivers for Hewitt's buyers and investors are:

- GHG emissions
- Forest cover and deforestation
- Regenerative agriculture (a problematic claim given it incorporates several other asset types and is poorly quantified).

The consolidated results from the assessments show:

In general, the Hewitt portfolio and the suppliers are performing above average, particularly when compared within a region.

- the range of assets to assess are complex, and in some cases a high or low score does not indicate higher performance
- key risks relate to deforestation and biodiversity, which are impacted to a greater degree in eastern properties
- risks can be managed to appropriate levels if management actions are undertaken.

Deforestation

The Deforestation Risk Assessment for Hewitt Agribusiness highlighted the significant risks and challenges associated with deforestation-free commitments in the context of Australian beef production.

A range of suggested processes have been provided to minimise risk, but an overarching risk is the actual definition or definitions that Hewitt are required to adhere to. While a key next step would be to lobby stakeholders towards accepting Cattle Australia's deforestation definition, it is more realistic to expect that Hewitt's stakeholders may not accept this and will still opt for a stricter version (i.e. AFi). Lobbying may need to be undertaken in conjunction with peak bodies with AFi to provide examples of the Australian context for land management with respect to regrowth. Acknowledged is MLA's non-policy or advocacy remit, rather the focus on exploring a define key research, development and/or adoption question(s).

7. Recommendations & future research

7.1. Carbon Emissions

Emission accounting is well established and can continue using the processes established. We recommend maintaining annual carbon accounting and product carbon footprinting.

Recommendations are provided that relate to improved emission accounting where knowledge gaps exist, and to future emission reduction activities.

Emission measurement:

1. Methane emissions for livestock grazing predominantly scrub lands are poorly understood and currently predicted from emissions measured on grass. Some Australian shrubs are anti-methanogenic and methane emissions may be lower than predicted for grass pastures. Further research is needed to fully understand the emission profile of rangelands cattle grazing predominantly shrubland environments, which are common in central Australia.
2. Methanotrophic activity in pastures and rangelands is currently excluded from the carbon account because of a lack of fundamental knowledge regarding methane breakdown rates. Further research is needed to quantify methanotrophic activity and the balance of methane emissions from these environments.
3. Methane emissions from Desmanthus pastures are uncertain and limit abatement estimation. Further research is needed to confirm if reduced methane production can be accounted when livestock are grazing Desmanthus pastures.
4. Methane calculation methods are needed that allow verification of methane reductions from cattle grazing Leucaena pastures. This is unlikely to require primary research on methane emissions. Focus is needed on quantifying abatement at paddock and property level without requiring excessive amounts of data.
5. LU and LUC methods, models, GIS data layers and test datasets are needed. This is part of the Federal Government workplan for GHG Standards, but is most likely 2 years from completion. In the mean time, further research to develop test datasets that can be used to calibrate models would be valuable.

Insetting:

Cost-effective and practical insetting methods and management practices are vital for making substantial emission reductions in rangeland supply chains. The following recommendations are provided:

1. Develop insetting methods for accounting for forest regeneration and develop management practices that foster regeneration of forests while maintaining livestock production and asset value.
2. Develop insetting methods for sparse woody vegetation and shrubs, and develop management practices that increase biomass in shrubland, to reduce net emissions.

3. Develop insetting methods for soil carbon sequestration with lower implementation costs, possibly using measure/model approaches.

Emission reduction:

1. The company is well positioned to progress with activities to drive emission reduction through productivity improvements. Current improvements in data collection at the individual animal level will enable better recording and demonstrate productivity improvements. This may be enhanced through use of walk-over-weigh systems. Weight for age, weaning rates and mortality rates are the key indicators that have the largest impact on carbon footprint and should be the focus.
2. Within the supply chain, ongoing engagement with suppliers should focus on targeting better growth rate cattle (higher weight for age) and better performing herds to reduce the carbon footprint of boxed product.
3. Cost effective and practical organic approved supplements are needed to deliver substantial long-term abatement. This is an ongoing, whole of industry priority. Developing products that can be delivered through water supplementation would be beneficial provided abatement is stable and can be suitably accounted and verified.

The above recommendations would be beneficial to a broader number of northern grazier stakeholders and could be developed collaboratively with other interested stakeholders including through a stage 2 MDC project.

Emission reduction modelling

As part of the Climate Disclosures regulations, Hewitt will need to provide climate modelling of future scenarios. Developing realistic emission reduction pathways that take into consideration the different warming impact of methane is an area that requires further work and industry level consensus on what is an acceptable emission reduction rate for pastoral companies. Models such as FaIR, tested in this project, offer opportunities for re-evaluating the rate of methane reduction needed based on long-term methane emission rates. However, the outcome of this modelling does not necessarily show that emission reduction rates need to be less than current Government policy. In the present case, reductions needed to be substantial to enable to the company to reach a 'zero warming' outcome by 2050. This presents an element of caution for methane exposed businesses and will likely shift the onus towards stabilising and slightly reducing methane over long-time horizons, to reduce warming to pre 2005 levels. Further work is needed to build a consensus approach for modelling.

7.2. Carbon data management

To improve auditability, aligning data sources already included in the companies' financial audits with data sources used for the carbon accounts would reduce auditing burden.

Improved datasets and detection products are also needed for vegetation and land use change detection and quantification. This is a whole-of-industry requirement and recommendation.

7.3. Natural Capital

The following recommendations are provided:

- Engage with Hewitt and supplier property managers to explain the NCA framework and results, and best-practice management to improve outcomes.
- Showcase suitable outcomes on the Hewitt website and share them with key stakeholders.
- Prepare a repeatable methodology that incorporates a 'light-touch' approach commensurate with the scale of reporting, but where field assessments are undertaken, verify a range of values including biodiversity, deforestation status, and insetting value. This can extend the current mapping program to include more indicators of relevance to stakeholders at both ends of the supply chain.
- Engage customers to showcase the capability of the program to measure and verify previously nebulous claims such as regenerative or nature positive.
- Develop and trial a tailored assessment approach for new property due diligence to quantify natural capital and evaluate risks.
- Working with stakeholders to clearly define frameworks and requirements for deforestation and natural capital reporting. Conduct annual exposure risk analysis of top buyers, investors, and legislative policies to stay abreast of key sustainability drivers and potential targets.
- Expand the assessment to all suppliers and undertake yearly repeat assessments for assets that can be spatially analysed
- Plan repeat monitoring for selected values, with appropriate intervals (e.g. annual for pasture, five yearly for habitat condition)
- Review work annually to maintain alignment with Taskforce for Nature-related Financial Disclosures (TNFD) framework and other emerging frameworks and legislation. This could include incorporating a Science-Based Targets Network (SBTN) programme to set science-based targets for water use and quality, and land conversion
- Consider limited public disclosures – this would demonstrate Hewitt is a market-leader in this space
- Conduct a targeted and integrated data collection field program to verify and bolster data spatially assessed, to set science-based targets, and to prepare for sequestration projects.
- Undertake more detailed assessments, such as AfN assessment of habitat condition, on a three yearly rotation, or integrate with other annual assessments to manage costs.
- Undertake conservation agreements on targeted areas of a property that can lead to multiple monetary, monitoring, environmental and stakeholder relationship benefits and should be evaluated on a case-by-case basis.

7.4. Deforestation Risk Management

The following recommendations are provided:

- Address the significant risks associated with deforestation-free commitments in the context of Australian beef production through collective policy action to help stakeholders (e.g. AFi

and EU) understand the Australian land management context and requirements for regrowth control.
- Navigate the complexities of deforestation risk, aiming for compliance with AFi standards and maintaining strong relationships with producers and stakeholders.
- Provide examples of the Australian context for land management with respect to regulated regrowth re-clearing.
- Engage customers to get feedback on the current assessment results and to communicate Hewitt's stance on deforestation and its risk management efforts.

7.5. Market engagement

Hewitt Foods have developed a premium product in the market with Organic Status. This has been augmented with Regenerative Organic Certification (ROC) and Climate Active carbon neutral status.

Some brands have expressed interest in “reduced carbon” product offerings and there is ongoing interest in ‘regenerative’ practices.

This program has established robust measurement and verification capability and has identified the opportunities that will achieve these outcomes. While few customers are currently willing to pay premiums for lower carbon emissions, there are opportunities to partner with customers to deliver lower emissions through joint projects. Developing these partnerships is vital for emission reduction.

We recommend developing a portfolio of emission reduction and regenerative opportunities with high-level costings that can be used to engage multiple customers and establish projects in the next 12 months.

We see a further opportunity to develop a **high claims regenerative brand**, which could also allow grain finishing of cattle. This would be differentiated from organic production and would have advantages for emission reduction and product quality, and may also enable a broader supply base. This could utilise the NCA system presented here to support environmental credentials for new market categories, by providing this program with nature credentials.

As a further option, the program could utilise the “Australian Farm Biodiversity Certification Standard”, while not administered by government, could be used as a framework to assess the portfolio against, enabling more robust claims to be made (e.g. “Narwietooma has achieved gold level status due to maintenance of habitat critical to threatened species including the bilby central rock-rat”).

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Appendix 1

Cattle Inventories

The following section includes inventories used to determine the carbon footprint for beef, which was completed as an average of the most recent three years of production.

Table A-1. Cattle herd inventory for 2021, derived from livestock records

Inventory	Steers	Females	Bulls
Breeder number		23,874	1,368
Young Livestock	35,873	36,081	
Natural increase	8,678	8,675	
Weaning rate		73%	
Mean weight (kg)	341	369	761

Table 2. Beef herd attributes for third party supplier groups

	Group 1	Group 2
Mean slaughter weight (kg LW)	294	337
Dentition at Abattoir	3.1	4.6
Primary production attribute		
Weaning rate (%) – grassfed	77	72
Age at slaughter (days) – grassfed	778	892
Mean Lifetime ADG (kg/day) – grassfed	0.66	0.65

Appendix 2

Desktop soil carbon stocks assessment

The 0-5, 5-15, and 15-30 cm layers from the Soil Organic Carbon predictions from CSIRO (Wadoux et al., 2022b, 2022a) were averaged and weighted proportionally to their respective depth range. These results are presented in Table 3 and Figure 44Figure 44. Weighted average soil carbon stock, in units of % total organic carbon. It is important to note that these soil carbon values are not suitable for developing a carbon market project or carbon neutral product.

Table 3. Summary total soil organic carbon (%) statistics from CSIRO soil carbon stock data

Property	Depth	95th percentile limit	5th percentile limit	Weighted average
Alpha Station	0-30 cm	1.978	0.261	0.951
Ambalindum	0-30 cm	0.985	0.001	0.348
Brewarranna	0-30 cm	1.918	0.353	1.007
Bylong	0-30 cm	3.542	0.431	1.661
Julia Creek Agg	0-30 cm	0.831	0.213	0.488
Narwietooma	0-30 cm	0.752	0.000	0.254
Oakleigh	0-30 cm	2.995	0.267	1.326
Oakwood	0-30 cm	1.487	0.212	0.682
Packsaddle	0-30 cm	0.914	0.000	0.386
Pegunny	0-30 cm	2.159	0.420	1.190
Pony Hills	0-30 cm	3.483	0.262	1.485
Tandou	0-30 cm	1.637	0.030	0.631
Tubbo Station	0-30 cm	1.773	0.392	0.966
Warilba	0-30 cm	1.697	0.433	0.975

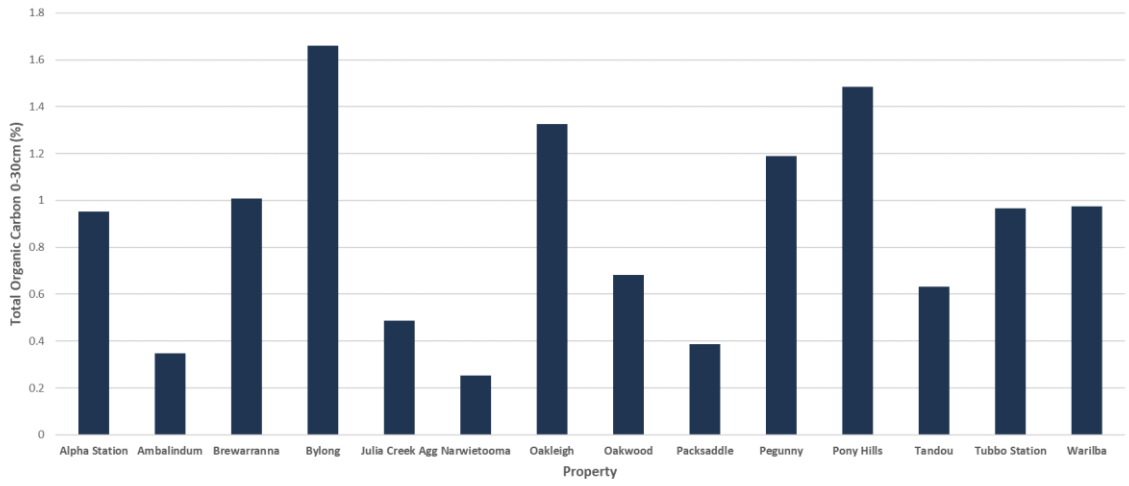

Figure 44. Weighted average soil carbon stock, in units of % total organic carbon

Figure 44 illustrates that the soil organic carbon content of all properties showed a range between 1.7% at Bylong to 0.3% at Narwietooma. Determining the role of soil carbon in a carbon account requires a measure of the change in carbon stocks. From soil testing alone, this requires repeat measures on the same land area.

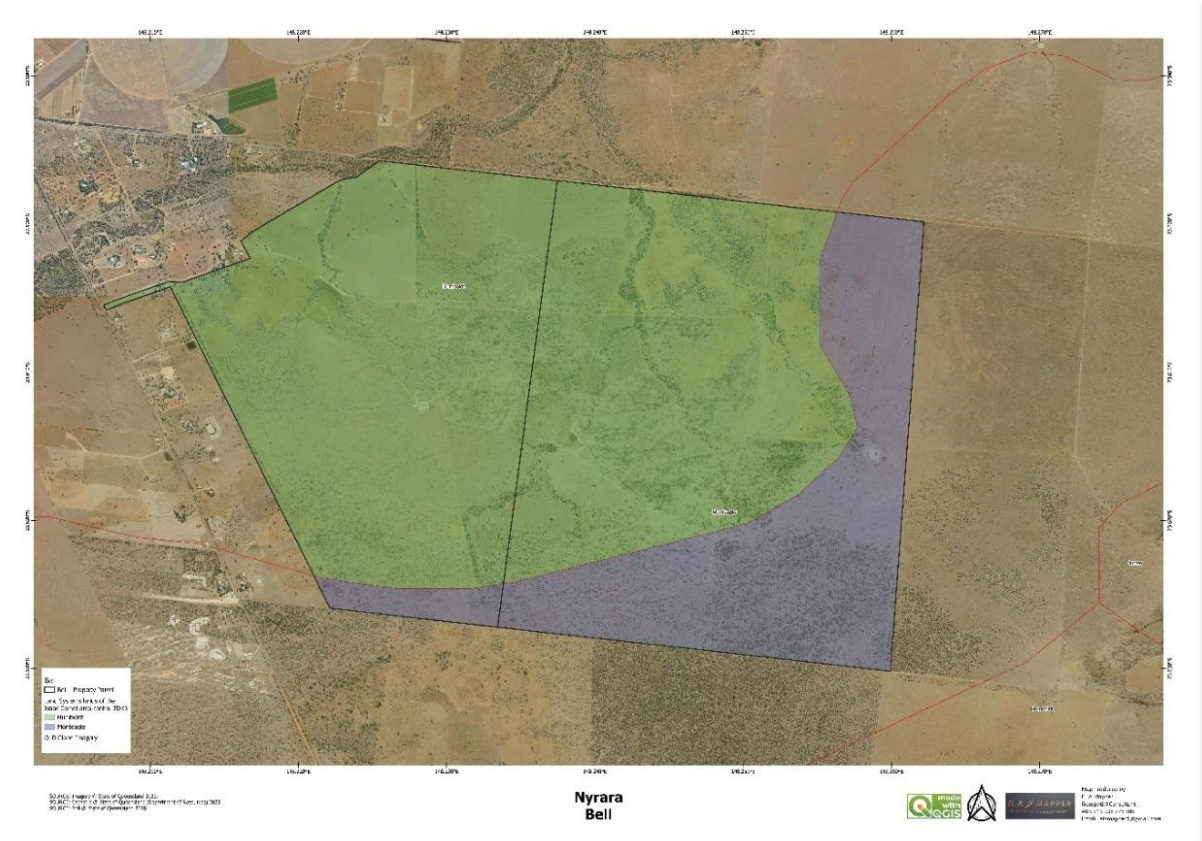

Figure 45. Soil extension material – property map & soil type description

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AGRICULTURAL SOIL ANALYSIS REPORT

1 sample supplied by Soil Land Food on 27/04/2023. Lab Job No.P0078

Analysis requested by Suwanna Thananupradi. Your Job: Arcadian/Hewitt 2023 - T.Bell

PO Box 881 ALBURY NSW 2640

			Sample 1	*Heavy Soil*	*Medium Soil*	*Light Soil*	*Sandy Soil*
		Sample ID:	1B				
		Crop:	Pasture				
		Client:	T.Bell	*Clay*	*Clay Loam*	*Loam*	*Loamy Sand*
	Parameter	Method reference	P0078/1	Indicative guidelines - refer to Notes 6 and 8			
	Soluble Calcium (mg/kg)	**Inhouse S10 - Morgan 1	683	*1150*	*750*	*375*	*175*
	Soluble Magnesium (mg/kg)		364	*160*	*105*	*60*	*25*
	Soluble Potassium (mg/kg)		38	*113*	*75*	*60*	*50*
	Soluble Phosphorus (mg/kg)		1.3	*15*	*12*	*10*	*5.0*
	Phosphorus (mg/kg P)	**Rayment & Lyons 2011 - 9E2 (Bray 1)	4.7	*45 note 5*	*30 note 5*	*24 note 5*	*20 note 5*
		**Rayment & Lyons 2011 - 9B2 (Colwell)	14	*80*	*50*	*45*	*35*
		**Inhouse S3A (Bray 2)	8.4	*90 note 5*	*60 note 5*	*48 note 5*	*40 note 5*
	Nitrate Nitrogen (mg/kg N)	**Inhouse S37 (KCl)	0.51	*15*	*13*	*10*	*10*
	Ammonium Nitrogen (mg/kg N)		2.9	*20*	*18*	*15*	*12*
	Sulfur (mg/kg S)		4.6	*10.0*	*8.0*	*8.0*	*7.0*
	pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	7.02	*6.5*	*6.5*	*6.3*	*6.3*
	Electrical Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.034	*0.200*	*0.150*	*0.120*	*0.100*
	Estimated Organic Matter (% OM)	**Calculation: Total Carbon x 1.75	1.5	*> 5.5*	*>4 .5*	*> 3.5*	*> 2.5*
	Exchangeable Calcium (cmol+/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	6.3	*15.6*	*10.8*	*5.0*	*1.9*
	Exchangeable Calcium (kg/ha)		2,833	*7000*	*4816*	*2240*	*840*
	Exchangeable Calcium (mg/kg)		1,265	*3125*	*2150*	*1000*	*375*
	Exchangeable Magnesium (cmol+/kg)		4.9	*2.4*	*1.7*	*1.2*	*0.60*
	Exchangeable Magnesium (kg/ha)		1,324	*650*	*448*	*325*	*168*
	Exchangeable Magnesium (mg/kg)		591	*290*	*200*	*145*	*75*
	Exchangeable Potassium (cmol+/kg)		0.21	*0.60*	*0.50*	*0.40*	*0.30*
	Exchangeable Potassium (kg/ha)		186	*526*	*426*	*336*	*224*
	Exchangeable Potassium (mg/kg)		83	*235*	*190*	*150*	*100*
	Exchangeable Sodium (cmol+/kg)		0.78	*0.3*	*0.26*	*0.22*	*0.11*
	Exchangeable Sodium (kg/ha)		400	*155*	*134*	*113*	*57*
	Exchangeable Sodium (mg/kg)		179	*69*	*60*	*51*	*25*
	Exchangeable Aluminium (cmol+/kg)	**Inhouse S37 (KCl)	<0.01	*0.6*	*0.5*	*0.4*	*0.2*
	Exchangeable Aluminium (kg/ha)		<1	*121*	*101*	*73*	*30*
	Exchangeable Aluminium (mg/kg)		<1	*54*	*45*	*32*	*14*
	Exchangeable Hydrogen (cmol+/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	<0.01	*0.6*	*0.5*	*0.4*	*0.2*
	Exchangeable Hydrogen (kg/ha)		<1	*13*	*11*	*8*	*3*
	Exchangeable Hydrogen (mg/kg)		<1	*6*	*5*	*4*	*2*
	Effective Cation Exchange Capacity (ECEC) (cmol+/kg)	**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol+/kg)	12	*20.1*	*14.3*	*7.8*	*3.3*
	Calcium (%)	**Base Saturation Calculations - Cation cmol+/kg / ECEC x 100	52	*77.6*	*75.7*	*65.6*	*57.4*
	Magnesium (%)		40	*11.9*	*11.9*	*15.7*	*18.1*
	Potassium (%)		1.7	*3.0*	*3.5*	*5.2*	*9.1*
	Sodium - ESP (%)		6.4	*1.5*	*1.8*	*2.9*	*3.3*
	Aluminium (%)		0.0	*6.0*	*7.1*	*10.5*	*12.1*
	Hydrogen (%)		0.0				
	Calcium/Magnesium Ratio	**Calculation: Calcium / Magnesium (cmol+/kg)	1.3	*6.5*	*6.4*	*4.2*	*3.2*
	Zinc (mg/kg)	Rayment & Lyons 2011 - 12A1 (DTPA)	0.64	*6.0*	*5.0*	*4.0*	*3.0*
	Manganese (mg/kg)		66	*25*	*22*	*18*	*15*
	Iron (mg/kg)		55	*25*	*22*	*18*	*15*
	Copper (mg/kg)		1.1	*2.4*	*2.0*	*1.6*	*1.2*
	Boron (mg/kg)	**Rayment & Lyons 2011 - 12C2 (Hot $CaCl_2$)	0.48	*2.0*	*1.7*	*1.4*	*1.0*
	Silicon (mg/kg Si)	**Inhouse S11 (Hot CaCl2)	58	*50*	*45*	*40*	*35*

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PO Box 881 ALBURY NSW 2640

		Sample 1	*Heavy Soil*	*Medium Soil*	*Light Soil*	*Sandy Soil*
	Sample ID:	1B				
	Crop:	Pasture				
	Client:	T.Bell	*Clay*	*Clay Loam*	*Loam*	*Loamy Sand*
	Parameter	**Method reference**	**P0078/1**	**Indicative guidelines - refer to Notes 6 and 8**		
	Total Carbon (%)	Inhouse S4a (LECO Trumac Analyser)	0.84	*> 3.1*	*> 2.6*	*> 2.0*	*> 1.4*
	Total Nitrogen (%)		<0.02	*> 0.30*	*> 0.25*	*> 0.20*	*> 0.15*
	Carbon/Nitrogen Ratio	**Calculation: Total Carbon/Total Nitrogen	58	*10–12*	*10–12*	*10–12*	*10–12*
	Basic Texture	**Inhouse S65	Clay	..	..	..	..
	Basic Colour		Brownish	..	..	..	..
	Chloride Estimate (equiv. mg/kg)	**Calculation: Electrical Conductivity x 640	22	..	..	..	..
	Total Calcium (mg/kg)	Rayment & Lyons 2011 - 17C1 Aqua Regia	1,586	*1000–10 000 Ca*			
	Total Magnesium (mg/kg)		1,592	*500–5000 Mg*			
	Total Potassium (mg/kg)		418	*200–2000 K*			
	Total Sodium (mg/kg)		204	*100–500 Na*			
	Total Sulfur (mg/kg)		64	*100–1000 S*			
	Total Phosphorus (mg/kg)		176	*400–1500 P*			
	Total Zinc (mg/kg)		16	*20–50 Zn*			
	Total Manganese (mg/kg)		662	*200–2000 Mn*			
	Total Iron (mg/kg)		17,436	*1000–50 000 Fe*			
	Total Copper (mg/kg)		10.0	*20–50 Cu*			
	Total Boron (mg/kg)		<2	*2–50 B*			
	Total Silicon (mg/kg)		785	*1000–3000 Si*			
	Total Aluminium (mg/kg)		11,926	*2000–50 000 Al*			
	Total Molybdenum (mg/kg)		<0.2	*0.5–3.0 Mo*			
	Total Cobalt (mg/kg)		19	*5–50 Co*			
	Total Selenium (mg/kg)		<0.5	*0.1–2.0 Se*			
	Total Organic Carbon (%)	LECO Trumac Analyser - Inhouse S15b	0.84	*< 0.5 (Very Low); 0.5–1.5 (Low); 1.5–2.5 (Medium); 2.5–5.0 (High); > 5.0 (Very High)*			
	pH	**Rayment & Lyons 2011 - 4B4 ($CaCl_2$)	6.01	..			

Notes:

1. All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to < 2 mm.
2. Methods from Rayment and Lyons, 2011. *Soil Chemical Methods - Australasia*. CSIRO Publishing: Collingwood.
3. Soluble Salts included in Exchangeable Cations - NO PRE-WASH (unless requested).
4. 'Morgan 1 Extract' adapted from 'Science in Agriculture', 'Non-Toxic Farming' and LaMotte Soil Handbook.
5. Guidelines for phosphorus have been reduced for Australian soils.
6. Indicative guidelines are based on 'Albrecht' and 'Reams' concepts.
7. Total Acid Extractable Nutrients indicate a store of nutrients.
8. National Environmental Protection (Assessment of Site Contamination) Measure 2013, Schedule B(1) - Guideline on Investigation Levels for Soil and Groundwater. Table 5-A Background Ranges.
9. Information relating to testing colour codes is available on sheet 2 - 'Understanding your agricultural soil results'.
10. Conversions for 1 $cmol_c/kg$ = 230 mg/kg Sodium, 390 mg/kg Potassium, 122 mg/kg Magnesium, 200 mg/kg Calcium
11. Conversions to kg/ha = mg/kg x 2.24
12. The chloride calculation of Cl mg/L = EC x 640 is considered an estimate, and most likely an over-estimate
13. ** NATA accreditation does not cover the performance of this service.
14. Analysis conducted between sample arrival date and reporting date.
15. This report is not to be reproduced except in full. Results only relate to the item tested.
16. All services undertaken by EAL are covered by the EAL Laboratory Services Terms and Conditions (refer SCU.edu.au/eal/t&cs).
17. This report was issued on 5/05/2023.

Quality Checked: Kris Saville
Agricultural Co-Ordinator KS

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Figure 46. Soil extension material – soil analysis example

Appendix 3

Workshop methods and approach

The workshops are planned to cater for a range of producers, including grazing (sheep, beef, goats), mixed farming, and cropping. The location for the workshops within this program dictated that the majority of attendees were focussed on beef cattle grazing. Each workshop was tailored to the primary production system, but catered for all attendees.

Data collection involved a group onboarding meeting to introduce the data collection process, and a description on the type of information required to complete the survey. Producers were then provided with the online survey. Project staff from Integrity Ag and Hewitt then contacted each participant for a 'one on one' meeting to review the survey, and address any questions about the assessment or the data required to complete the survey.

Following return of production data from participants, an assessment was completed to provide an estimate of the carbon footprint of beef and/or sheep production for the average of your livestock sales for a financial year (FY). The estimate is 'cradle to gate': it includes livestock GHG emissions sources (scope 1 livestock emissions), as well as emissions from pre-farm sources (scope 2 & 3, e.g., from purchased inputs, including emissions from purchased animals). The unit of measurement is kilograms of greenhouse gases (converted to CO_2-equivalent amounts) per kilogram of corrected animal (liveweight) sold. (Note: LW sold was corrected when herds were expanding or contracting to remove the influence of herd fluctuations). The product carbon footprint was determined following the methods outlined in the ISO 14067: 2018 and the global beef carbon footprint guidelines (LEAP, 2015), as applied in the published study of Wiedemann et al. (2015).

Vegetation (tree) carbon change was assessed using the Forest Carbon Report (Cibo/Mullion). This report was generated to confirm no net loss in forest carbon and to indicate levels of carbon sequestration (removals of carbon from the atmosphere). It is noted that this assessment was not used as a 'removal' in a product carbon footprint without a verified method that ensures sequestration (removals) in one year are not lost in subsequent years.

Soil carbon was not assessed due to currently pending methods that can be applied at scale and verified. Soil can contribute to carbon emissions or removals. Current methods in Australia recommend 'zero change' for well-managed grazing land. In isolated cases, soil carbon loss can occur (for example, where pastures are cultivated for cropping). Soil carbon increases can contribute to removals, but this requires a verification method that ensures sequestration (removals) in one year is not lost in subsequent years. Currently, this requires extensive on-site soil testing of baseline conditions and ongoing soil testing to confirm change over time.

A producer workshop was held in locations selected by Hewitt. The workshops were made available to producers in the region, along with related service providers (i.e. financiers, rural consultants, financiers etc). The workshop covered topics such as: GHGs in agriculture and carbon sequestration sources, emissions from livestock and farm inputs, key aspects influencing emissions, comparison of results against benchmarks; vegetation carbon storage, opportunities to reduce emissions and store carbon. A summary of workshop participation can be seen in Table 4, a listing of the project analysis and findings are listed in the results section.

Table 4 – Workshop engagement summary

Location	State	No. Invitees	No. Attendees	No. Surveys
Augathella	QLD	26	14	4
Bedourie	QLD	28	17	5
Clermont	QLD	20	11	8
Longreach	QLD	11	8	5
Moura	QLD	20	14	6
Roma	QLD	20	10	6
Broken Hill	NSW	15	15	5
Wagga	NSW	31	17	4
Alice Springs*	NT	-	-	-
Total		171	106	43

Workshop in this location was cancelled due to insufficient producer availability. Onboarding was completed, but workshop was not completed.

Workshop Summary

The following tables provide summaries of baseline data on emissions assessment for each producer in the workshop series.

Beef and sheep enterprise GHG emissions results were collated from each workshop and reported as product carbon footprint (kg CO_2-e kg LW^{-1}) (see Figure 47 & Figure 48). The average product carbon footprint result for beef assessments was 11.8 kg CO_2-e kg LW^{-1}, and for sheep was 7.5 kg CO_2-e Lg LW^{-1}.

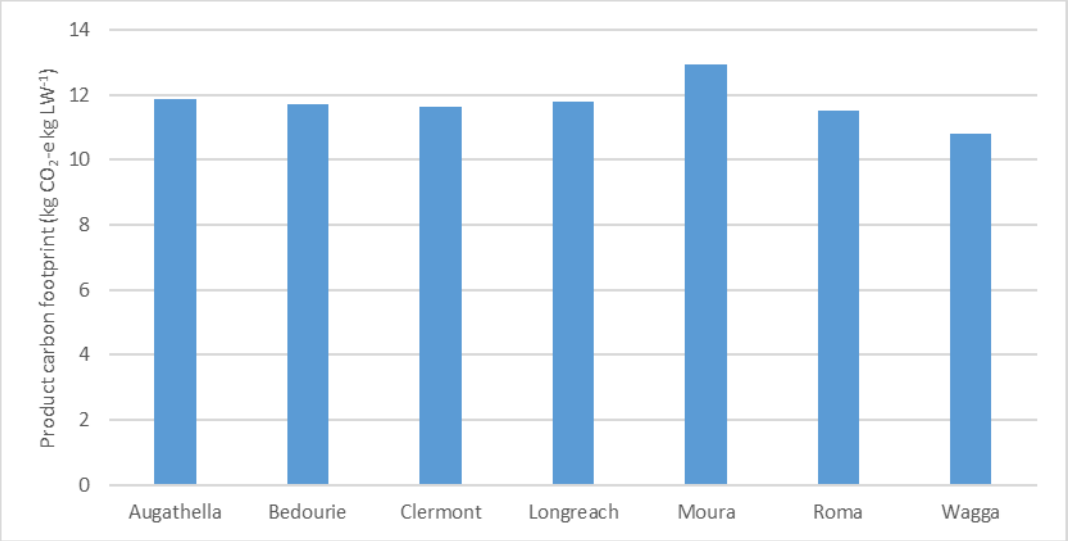

Figure 47. Summary of average product carbon footprint (kg CO_2-e kg LW^{-1}) results for beef by workshop location

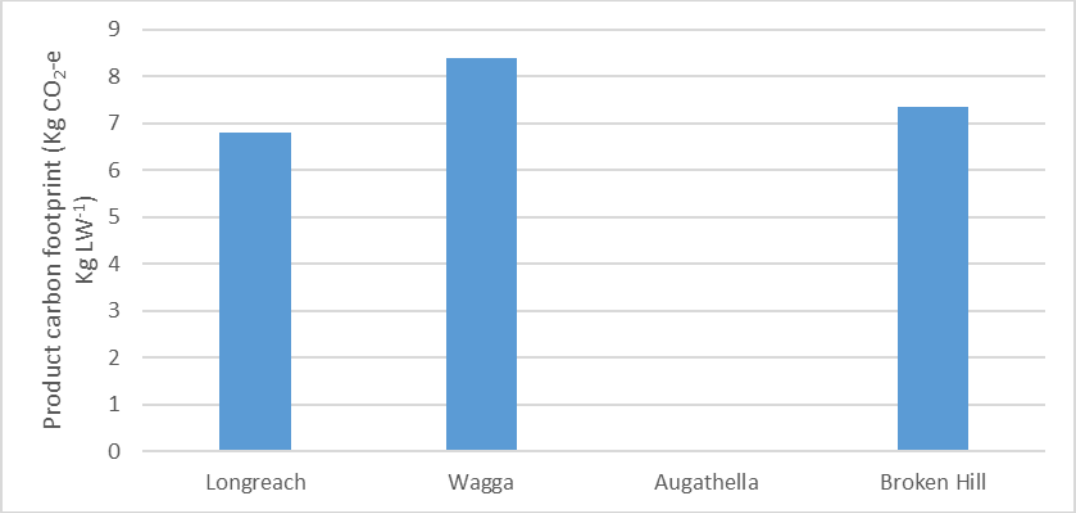

Figure 48. Summary of average product carbon footprint (kg CO_2-e kg LW^{-1}) results for sheep by workshop location

Workshop participants – production metrics

Enterprise production metrics for beef producer are displayed in Table 5 by workshop location.

Table 5 – Beef producer production metrics by workshop location

Location	Breeder Herd Size (Avg.)	Land areas (Avg. Ha.)	Breeder Weight (kg. Avg.)	Weaning % Avg.	Lifetime ADG (kg Avg.)	Weight at Turnoff (KG. Avg.)
Roma	607	17,044	555	86%	0.70	551
Clermont	1,025	17,517	511	83%	0.61	487
Moura	1,174	22,177	603	79%	0.70	548
Bedourie	10,548	1,721,200	539	73%	0.63	490
Augathella	1,591	110,333	519	75%	0.75	644

For beef producers, enterprise scale is displayed on a breeder inventory basis in Figure 49 & and on a land areas basis in Figure 50.

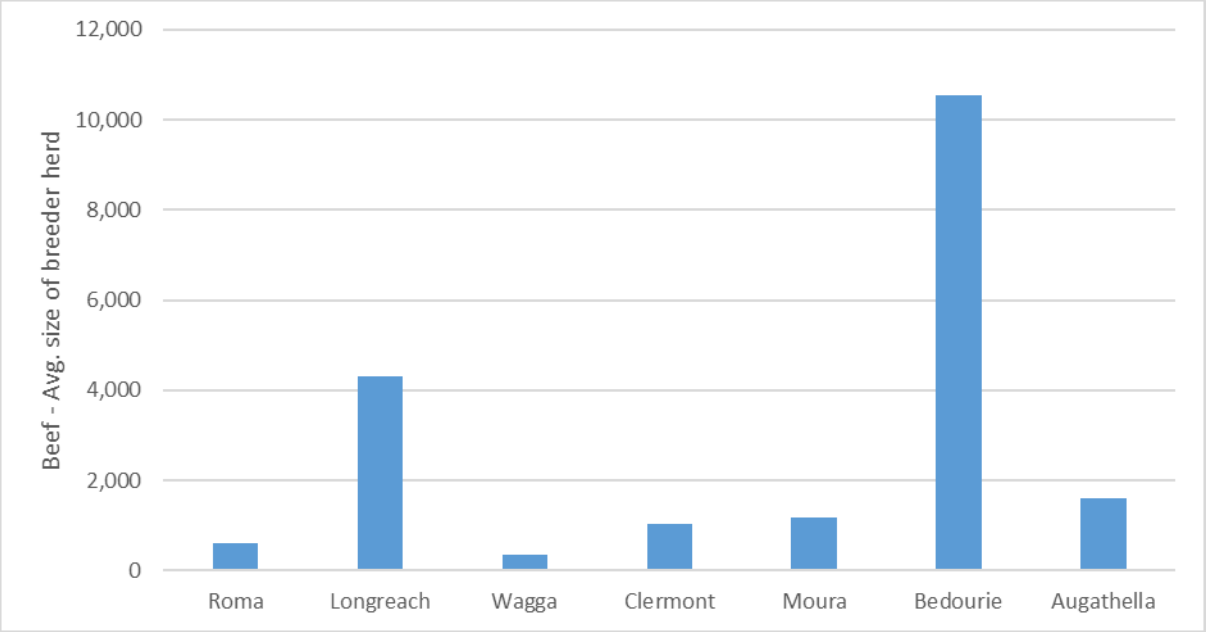

Figure 49**. Beef producer average size of breeder herd by workshop location**

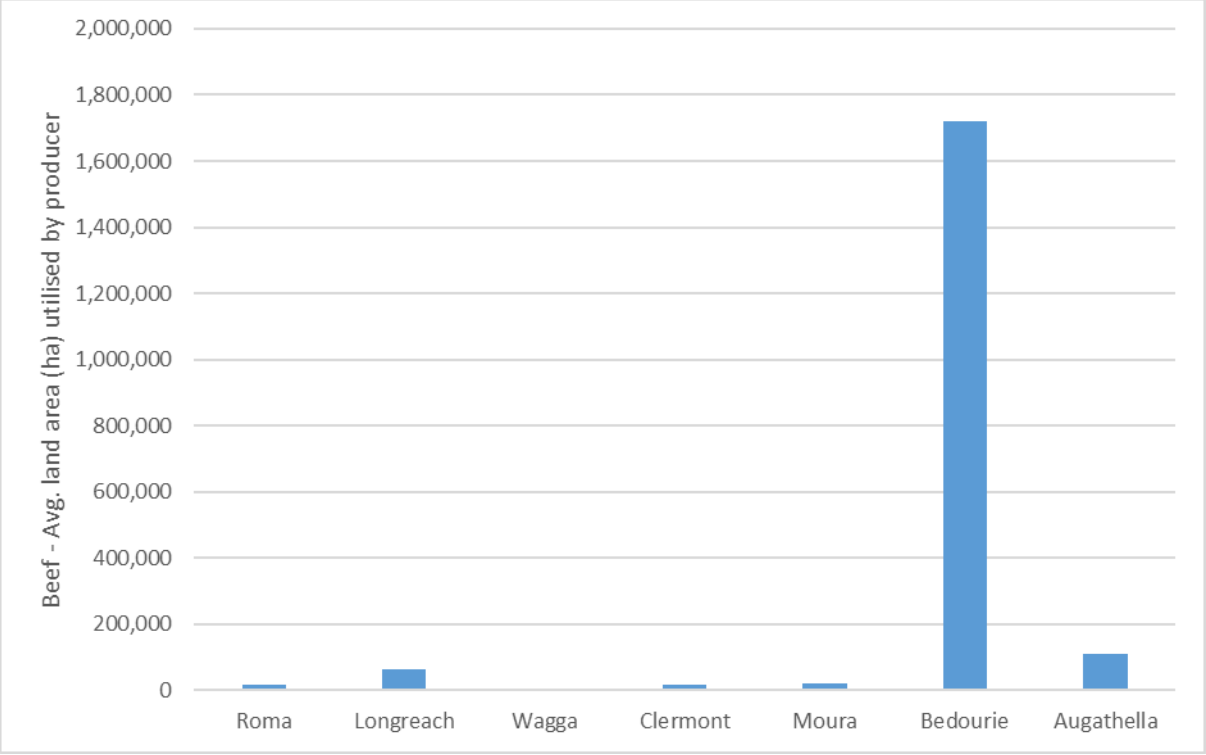

Figure 50**. Average land area (Hectares) utilised by beef producers by workshop location**

The sales completed by the beef and sheep enterprises are displayed in Figure 51 & Figure 52.

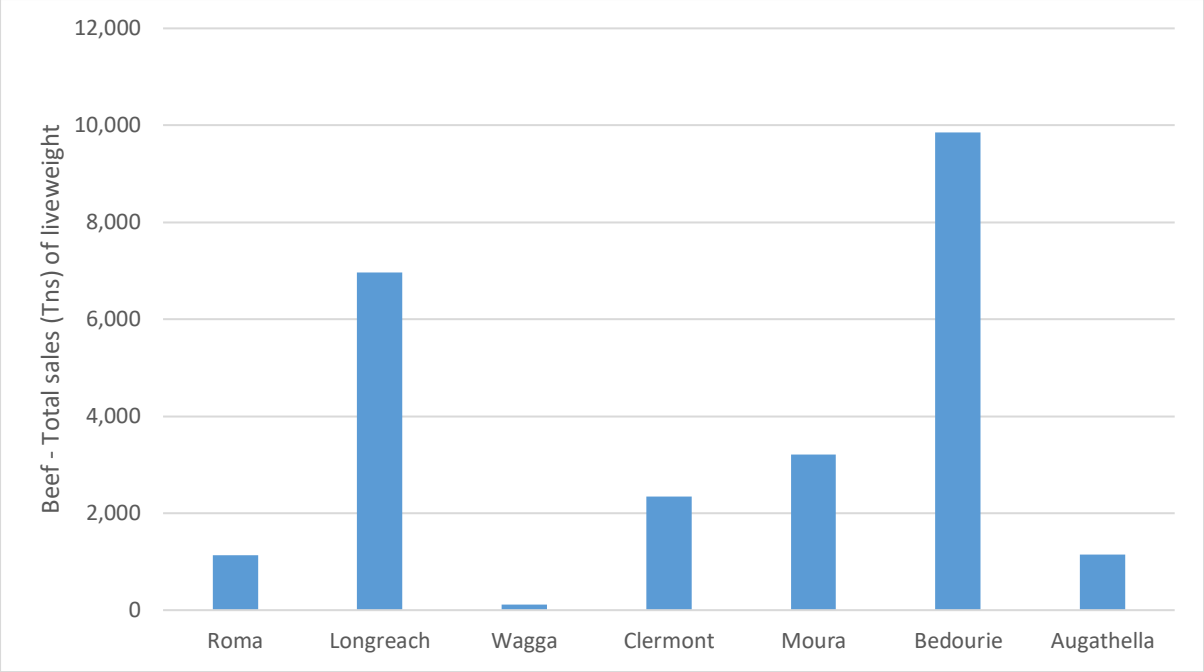

Figure 51. Total sales of liveweight for beef producers by workshop location during assessment period

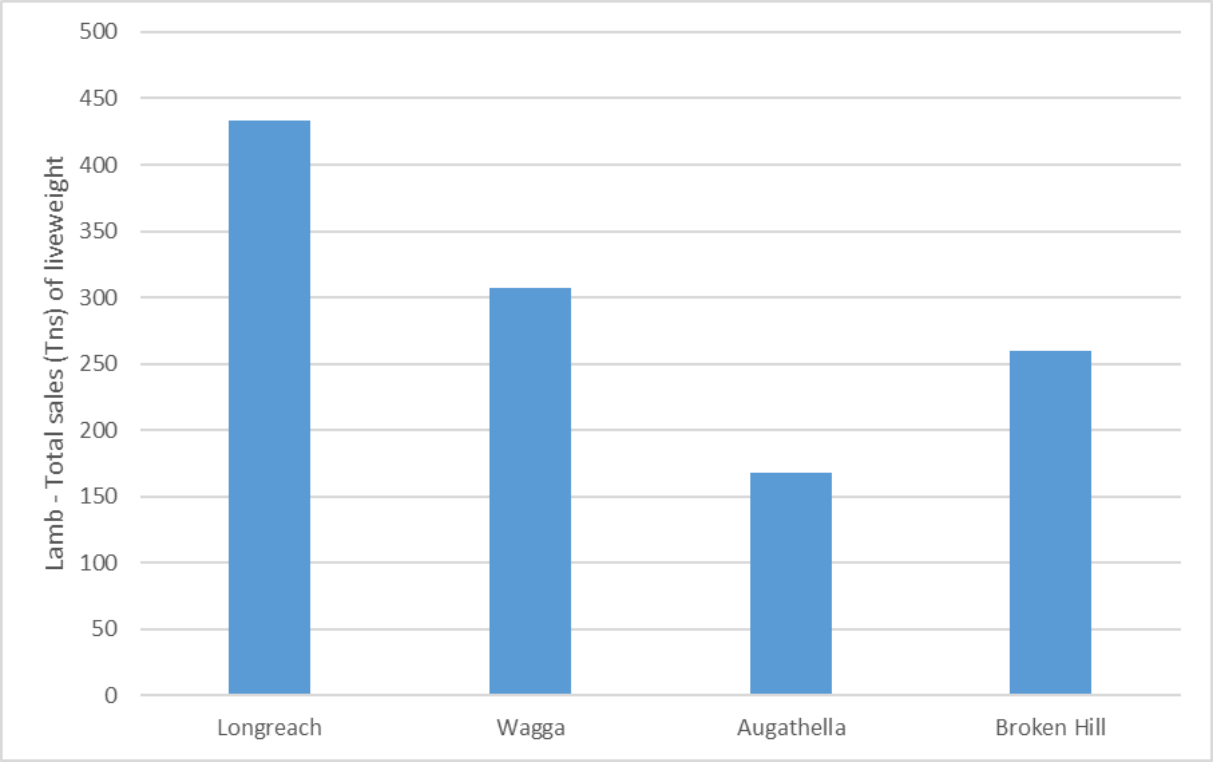

Figure 52. Total sales of liveweight for sheep producers by workshop location during assessment period

Feedback from participants

At the conclusion of the workshop sessions, participants were given the option to provide feedback on the session, and their outlook for the broader landscape of carbon within their business. A total of 27 participants completed this survey. The survey listed 16 questions. Of these, 4 have been selected as being the most indicative of producer's perspectives.

1. How sufficient was the support you received from IA to complete the data survey?
2. How likely are you to continue recording and monitoring your product carbon footprint?
3. Did the introductory webinar adequately explain the steps involved in the program?
4. Do you use on-farm computer program for records?

A summary of the responses is outlined below. The responses were ranked from 1-5, with 1 being "very unlikely" through to 5 being "very likely".

Question	Response						
	1	2	3	4	5	Yes	No
1	4%	0%	37%	7%	52%		
2	7%	7%	30%	19%	37%		
3						75%	15%
4						59%	41%

Appendix 4: Natural Capital Exposure Assessment

Table 38. Exposure assessment: Relevant natural capital goals of Hewitt stakeholders

Natural-capital-related goals and focus areas	Material impacts and dependencies	Disclosure framework *
Greenhouse Gas Emissions targets They are committed to contributing to the pathway of restricting global warming to below 1.5°C. By 2025, will source 100% renewable electricity to power their business and have net positive carbon emissions. Reduce absolute scope 1 and 2 greenhouse gas emissions by 80% by F30 and by 90% by F45 from a F23 base year. Reduce absolute scope 3 GHG energy and industrial emissions by 55% by F33 and 75% by F50 from a F23 base year. See report for specific land and agriculture (FLAG) and energy and industrial emissions goals. Their scope 3 targets are twofold adopting SBTi FLAG guidance to reflect: the vastly different challenges and opportunities on-farm those associated with energy and industrial emissions as relevant to our sector. They are in the early stages of activating strategic initiatives to reduce their scope 3 emissions, but they are encouraging suppliers to participate in their value chain emissions program using THESIS assessments and goals/approval from SBTi. Responsible Stewardship of Natural Resources goals: To understand the impact and dependencies of their priority fresh supply chains on nature and increase supplier adoption of sustainable and regenerative practice by 2025. Reduce their water use by 10% by 2025 (2020 baseline). Deforestation goals including for beef in Australia: No Deforestation across their primary deforestation-linked commodities (beef, pulp, paper, timber, palm oil, cocoa, tea, coffee, soy) with a target date of 31 December 2025. They reference the SBTi definitions of “deforestation” and “natural forest” and will interpret and apply these definitions in the appropriate context to their supply chain, industry and geography. They are engaging across the Australian beef industry in pursuit of a geographically appropriate definition of deforestation that meets global regulatory requirements and corporate deforestation targets.	Greenhouse Gas emissions General biodiversity Regenerative agriculture Water Use Deforestation Biodiversity and Ecosystems Land conservation and restoration Forest cover and deforestation Sustainable grazing and land management	EU SDG / SBTi (deforestation and GHG) None noted TCFD / TNFD / SBTi / UN Sustainable Development Goals / PCAF (Partnership for Carbon Accounting Financials) standard for accounting and disclosing Financed Emissions / Kunming-Montreal Global Biodiversity Framework (GBF) Not applicable TCFD / SASB / UN Sustainability

Natural-capital-related goals and focus areas	Material impacts and dependencies	Disclosure framework *
They will continue to assess the risk of deforestation in their beef supply chain to inform their approach to monitoring and reporting progress against their no-deforestation target. Their approach is founded in a principle of a just transition. Future of protein goals: By 2025, source our animal, and alternative protein sources in a sustainable manner through minimising our impact on the environment. Regenerative Agriculture Claims Policy Ensure that all products with claims about regenerative or organic practices/ingredients require third-party certification/verification such as Regenerative Organic Certified, Regenified, or Ecological Outcome Verified. Partner with Fair Trade (USA and International), Rainforest Alliance, Fair Food Program and previously mentioned certification programs to advance sustainable farming practices: Sourced for Good program products e.g. for planting trees to prevent erosion Climate for a Resilient Food Systems program Climate-smart agricultural farming methods Programmes include provisions around soil health, pesticide usage and protection of biodiversity and native ecosystems. Decarbonisation and ecosystem services program partnering with HowGood to: Measure their Private Label food products carbon footprint and to onboard additional products To also analyse the water footprint of products They plan to work with their suppliers to implement approaches for strong water stewardship and to mitigate water scarcity Reduce Deforestation Risks Source 100% of fresh beef from regions of low deforestation risk or with fully supply chain traceability to demonstration the product did not contribute to deforestation. Greenhouse Gas Emissions Goals To support the transition towards a net-zero economy by 2050, and to set emission reduction targets that help limit global warming (with a likely limited/no overshoot) to 1.5 degrees Celsius by the end of the century.	Water use and quality Greenhouse Gas Emissions Greenhouse Gas emissions General Biodiversity Natural Ecosystem condition Deforestation Water usage Soil quality Threatened plant and animal species Conservation and restoration Carbon sequestration Regenerative agriculture	Development Goals (for their own disclosures) SBTi guidance for reducing scope 3 emissions since 2020 (for them and local brands) / GHG Protocol / ENCORE's natural capital model GRI materiality assessment and aim to report under the ISSB standards ISO 31000:2018 Risk management – Guidelines / UN Sustainable Development Goals / TCFD disclosures (own) / Considering TNFD None noted

Natural-capital-related goals and focus areas	Material impacts and dependencies	Disclosure framework *
They disclose their own operational activities GHG emissions and report on the CO2-e emissions of their customers linked to their financing (scope 3 financed emissions). They also report on financed customer activities that have helped avoid GHG emissions e.g. increasing the supply of renewable energy. They encourage farmers to measure on-farm emissions and now calculate emissions intensities for their Australian beef portfolio. Value Nature goals To integrate nature in our way of working by 2030 and to live in harmony by 2050. They are a member of the TNFD When deciding to fund new agricultural customers, they use a 9-grid-box system to determine the initial status on sustainability as a farmer. Objectives towards 2030, is to leverage their banking activities to: Halt deforestation and land conversion. Avoid impacts and protected key biodiversity areas. Minimize pollution to safeguard water and soil quality Minimise impacts on threatened species Restore degraded ecosystems Steer on good agricultural practices, reduce food loss and waste, and protein diversification. Sustainable Food and agriculture sector They work on opportunities to help producers. reduce GHG emissions remove and capture CO2 in their soils, crops, and the trees. Regenerative agriculture target They support regenerative agriculture to restore agricultural land, and to reduce environmental impact, including reducing GHG emissions. Deforestation goals They have a no deforestation policy but strongly believe that the best way we can contribute to a future-proof food system is by actively participating in it, with customers and other stakeholders Minimisation of deforestation globally.	Deforestation Greenhouse Gas emissions Regenerative Agriculture Deforestation Land conservation and restoration Natural ecosystem condition Water usage Soil health Pasture cover Greenhouse Gas emissions Carbon sequestration Regenerative Agriculture	Noted that adoption of TNFD a likely requirement by 2026. Not applicable

Natural-capital-related goals and focus areas	Material impacts and dependencies	Disclosure framework *
Implement a Global Energy strategy to drive change to meet their: scope 1 and 2 direct absolute emissions reduction target of 39%, and supply chain scope 3 emissions (excluding fuel) reduction target of 20% by 2030 from baseline. Enact their scope three action plan's key pillars including: supplier energy transition e.g. use clean energy regenerative and deforestation-free agriculture engaging suppliers on supply chain traceability sustainable livestock e.g. reduce intensity of emissions Implement a Forest Conservation Commitment to not source beef from high-risk deforestation regions (focus on tropical deforestation in South America) until comprehensive traceability and monitoring systems are in place. Land Stewardship Goals to support good land stewardship with suppliers include: Avoiding deforestation and conversion of natural ecosystems, and conserving/restoring natural ecosystems including high value/carbon stock forests Protecting water resources Protecting, restoring and promoting soil health Responsible grazing e.g. maintain health of grasslands and improving soil quality. Greenhouse Gas emissions targets 50% reduction in absolute scope 1 and 2 CO2 equivalent emissions by 2030, and net zero 90% reduction and 10% removals by 2040, against the 2018 baseline. 1.5 degrees C aligned targets, with 2020 as the baseline year, for scope 3 targets. Reduction target of 37% for 2030 and net-zero by 2050 from the 2020 baseline. Refer to the report for their updated forest, land, and agriculture (FLAG) and non-FLAG emissions, referred to as Energy and Industrial sector (E&I) targets that incorporate the latest SBTi guidance on emissions. To reduce GHG emissions across their supply chain they: Encourage accelerated supplier implementation of science-based targets e.g. set own emissions-reductions targets. Encourage suppliers to invest in developing low-carbon products with less embedded emissions. Encourage livestock suppliers to reduce GHG emissions by focusing on enteric fermentation and manure management.	Land conservation and restoration Deforestation General Biodiversity Natural ecosystem condition Greenhouse Gas emissions General Biodiversity Conservation and restoration Greenhouse Gas emissions General biodiversity Land conservation Threatened plant and animal species	

Natural-capital-related goals and focus areas	Material impacts and dependencies	Disclosure framework *
They encourage agricultural suppliers to reduce or sequester emissions through activities such as: optimize the use of fertilizers and pesticides. use regenerative and sustainable agricultural methods. taking measures related to agroforestry, afforestation, and reforestation. Sustainable farming practices goals are: To integrate sustainable agriculture expectations into their own brand sourcing requirements. To work with suppliers to adopt sustainable agriculture practices that include conserving natural resources, reducing land conversion, and improving soil health. They aim to develop a science-based Regenerative agriculture strategy for their own U.S. brands. The strategy will guide the brands' future work on regenerative agriculture within the U.S. value chains. Deforestation-free supply chain goals In 2023, started to prepare for the EU's Deforestation Regulation by mapping supply chains and engaging with suppliers. By 2025, they aim to have 100% of their own-brand products containing soy, palm oil, cocoa, coffee, wood fiber, and tea certified against an acceptable standard that provides for no deforestation or land conversion. Develop an updated approach to biodiversity with a broader nature plan to guide their global approach until the end of 2025. They have conducted a high-level impact and dependency assessment using ENCORE's natural capital model. They are reviewing their current approach and will further look at: Conducting a detailed impact/dependency and risk assessment. Reviewing existing and setting new targets. Implementing action within their brands. Enhancing their disclosure of nature-related impacts. Greenhouse Gas emissions goals They are continuing to reduce their scope 1 and 2 operational emissions target, with a 65% reduction compared to 2020. Their scope 3 operational emissions target is a 32.7% reduction in absolute emissions by 2030, against a 2020 baseline. They are reducing their own operational emission by: sourcing renewable electricity equivalent to 100% of our power needs globally by 2030	Deforestation Greenhouse Gas emissions Pasture Cover Soil health Regenerative agriculture Greenhouse Gas Emissions Soil quality Threatened plant and animal species Conservation and restoration General Biodiversity Conservation and restoration	

Natural-capital-related goals and focus areas	Material impacts and dependencies	Disclosure framework *
monitoring and reducing Supply Chain emissions aligned to our scope 3 emissions reduction target Supporting the transition to a net zero emissions economy by e.g. not financing new coal mines or power plants Supporting customers in a low-carbon economy Supporting the responsible global transition to net zero emissions by 2050. They haven't set targets for the Australian agriculture sector at this stage. Biodiversity and Nature They recognise the risk associated with the degradation of ecosystems and natural resources. They seek to take action to maintain, enhance, and restore biodiversity as highlighted in the Kunming-Montreal Global Biodiversity Framework. They seek to contribute to these global efforts in the following ways: committed to complying with, or exceeding, the requirements of environmental legislation relevant in all areas in which they operate. They recognise the challenges that biodiversity loss and water scarcity presents and consider these impacts as part of the environmental, social, and economic assessment of large transactions. Agriculture and forestry They support the adoption of sustainable practices in the agriculture, fisheries, and forestry industries. For large transaction projects they expect clients who are producers of beef to be able to demonstrate how they manage sustainability considerations in their business activities. They are developing a Climate Transition Plan to bring together longer-term targets to: Reduce emissions. Address nature-related impacts. Drive circularity Greenhouse Gas Emissions targets To reduce combined scope 1 and 2 emissions by more than 75% (FY20 baseline) by the end of FY30 and to net zero by 2050. Scope 3 supplier engagement target is to have that 75% of their suppliers have science-based emissions reduction targets by the end of FY27. They are still considering how best to account for scope 3 emissions, in particular, the aspects related to Forestry, Land and Agriculture (FLAG), and the manufacturing emissions impacts.	Natural Ecosystem condition Deforestation	

Natural-capital-related goals and focus areas	Material impacts and dependencies	Disclosure framework *
Meat supply chain focus For their Finest Carbon Neutral Beef supply chain, feed supplement Bovaer plays a role in their strategy to reduce emissions throughout. Implemented an emission-focused supplier engagement program for beef and lamb producers through Integrity Ag. The workshops form the beginning of a focused sustainability program, calculating on-farm greenhouse gas emissions, and exploring production efficiencies and potential emissions reduction opportunities. Their sourcing and farming goal is to deliver positive outcomes for nature Their GRAZE Beef and lamb program. GRAZE cattle are selected to high standards (grass-fed, free to roam on pastures, and have no added hormones) and meet the GRAZE Grass-fed Standard. GRAZE supports tree planting programs, and the monitoring and/or management of on-farm biodiversity including monitoring wild flora and fauna, fencing off areas to protect vegetation. Sustainable products goals To minimise deforestation, they have an independent and internationally recognised certification and verification program to support environmental protection for products such as timber, pulp, paper, palm oil, cocoa, tea, coffee, sugar, soy and cotton. Goals to support action for nature include: Developing a nature roadmap to identify and support action for nature and will set out key actions required and what needs to be prioritised. They are considering several stakeholder views and disclosure requirements, including TNFD. They are annually doing a materiality assessment. They are aligning with UN Sustainable Development Goals and support nine of the 17 SDGs. Outside of sustainability report, Coles may be using THESIS assessments and goals/approval from SBTi. Broad sustainability goals are to: reduce their climate impact promote land health		

Natural-capital-related goals and focus areas	Material impacts and dependencies	Disclosure framework *
To ensure their metrics for ecological outcomes, animal welfare, and human rights, are aligned with industry standards, they are working with Generalised Regenerative Agriculture Sourcing Specifications (GRASS) and the Textile Exchange Regenerative Outcomes Framework They encourage regenerative agriculture: The first efforts are focused on grass-fed beef and specifically that all their hotdogs will be made with certified regeneratively raised beef by the end of 2025 They are implementing the Applegate regenerative standard that offers suppliers several third-party certifications to choose from to measure land health outcomes These are Regenerative Organic Certified, Land to Market Ecological Outcome Verification™ and Greenham Beef Sustainability Standard (endorsed by Certified Humane) – tier 2. Climate Strategy – a commitment to use their capital and influence to support the transition to global net-zero greenhouse gas emissions by 2050. to upgrade their climate change strategy, drawing on the lessons learnt since its launch, to drive better investment outcomes and ensure that their focus on climate change improves the organisation's ability to deliver on its mandate. Green Asset Taxonomy – tools and templates developed To support investments that consider their carbon footprint a decision-making template was designed to help teams conduct quantitative assessments of potential investments and to analyse the potential effects of an investment on PSP's portfolio carbon footprint. To monitor their investments and portfolio against their climate metrics they developed specific tools. To collect GHG data from their private markets' investments through the Green Asset Taxonomy dashboard and climate pathways navigator tool. The tool aims to provide detailed insights into their investments and to enable more informed decision-making and strategic planning at both asset and portfolio levels. Range of legislation including but not limited to: Environmental Protection and Biodiversity Conservation Act (Commonwealth), Nature Conservation Act 1992 (QLD State), Vegetation Management Act 1999 (QLD State),		

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Biodiversity Conservation Act 2016 (NSW State), Local Land Services Act 2013 (NSW State), Pastoral Land Act 1992 (NT), Territory Parks and Wildlife Conservation Act 1976 (NT)		

** Material impacts and dependencies were identified within the Additional sector guidance: Food and agriculture (TNFD 2024), and The Natural Capital Handbook (Smit et al. 2023).*