



The economic benefits of trees on farms

Project insights

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August 2025

Contents

Contents	2
Message from CommBank	3
Message from the <i>Farming for the Future</i> Program Director	3
Acknowledgements	4
Executive summary	6
Collaborating for positive change	8
Outcomes from the <i>Farming for the Future</i> research – CommBank collaboration	9
Introduction to natural capital in agriculture	10
Overview Shade & shelter services provided by trees	12
Project approach.....	13
Benefits from trees for the Australian broadacre zone	14
Key concept Proximity	15
Making the insights actionable for farmers.....	16
Bringing integrated tree plantings onto the farm’s balance sheet	17
Next steps and recommendations for future research	22
References	23

Related documents

The following documents provide further information.

Document title	Description	Location
FFTF Value of trees on farms – Key Technical Concepts	Detailed explanations and illustrations for the methods, information and maps provided in the participant reports.	https://farmingforthefuture.org.au/wp-content/uploads/2025/08/FFTF-Farm-Value-of-Trees-Insights-Report-Key-Technical-Concepts-August-2025.pdf
Livestock pilot findings demonstrate natural capital boosts production, profit and resilience	Summary of the FFTF research findings. Suitable for a semi-technical audience.	https://farmingforthefuture.org.au/wp-content/uploads/2025/05/Initial-findings-of-FFTF-Livestock-Pilot-2025.pdf
Benefits of trees on farms report for Roslyn Estate February 2025	A publicly available example of the farm report provided to participating farmers in this project.	https://farmingforthefuture.org.au/wp-content/uploads/2025/08/Roslyn-Estate_FFTF-Value-of-Trees-on-Farm_report_v1.0.pdf

Message from CommBank

At CommBank, we are proud to support Australian agriculture and the farmers who are at its heart. Our sponsorship of the Farming for the Future program reflects our commitment to farm businesses and seeing them thrive with nature-based solutions that deliver productivity, profitability, and climate resilience.

This report into the economic benefits of trees on farms highlights how natural capital—such as shade and shelter—can be measured and valued as a contributor to farm performance. The research shows that trees provide tangible benefits to livestock weight gain, survival and pasture productivity. These services can be translated into financial value for farm businesses.

Supporting farmers as they manage their natural capital is essential to building a more sustainable and resilient agricultural sector. CommBank is committed to enabling Australia's transition to a net zero economy by 2050. This includes working with farmers to unlock opportunities that improve environmental outcomes while strengthening business performance.

Through our collaboration with *Farming for the Future*, we are helping raise awareness of the important integration of natural capital in farm management and valuation practices. This understanding supports farmers as they make informed decisions that benefit their business, their land and the future of agriculture.

We look forward to continued collaboration with *Farming for the Future* and our shared support for Australian agriculture.

Carmel Onions
Executive Manager Agribusiness Sustainability
CommBank

Message from the *Farming for the Future* Program Director

While the economic value of trees on farms has been widely known for some time, methods to reflect these values in natural capital accounts for farm businesses are still emerging. It is essential to quantify these benefits in both physical and monetary terms and present this information in a manner that makes these values transparent and enables informed action.

We are passionate about enabling farmers to optimise their farmlands for the resilience and productivity of their farm businesses and to meet their personal goals as well as those of society. The work in this project was designed to build on prior work in natural capital accounting at the farm scale and to apply or adapt methods used in the United Nations System of Environmental Economic Accounting and by financial accounting professionals, aiming to improve the information provided on natural capital to enhance decision-making and financial capital allocations.

This project was supported with funding from the CommBank and with the wisdom and experience of Carmel Onions. Carmel's knowledge of the industry, strategic foresight, and skills in industry engagement and collaboration have been a key ingredient in making these important advances in the valuation of trees on farms. We are very proud of the achievements of the *Farming for the Future* program so far, and we thank The CommBank for the significant contribution you have made to the work. We also thank the farmers, farm advisors, and property valuers who participated in this project and shared their insights and experience with us.

Yours sincerely

Sue Ogilvy

Program Director

Acknowledgements

Farming for the Future acknowledges the traditional owners of the lands on which we live and of the lands involved in the research. We pay our respect to their Elders past, present, and emerging.

We appreciate the support of our philanthropic and industry partners including the Macdoch Foundation, Rebecca Gorman, Yulgilbar Foundation, Morris Family Foundation and others plus funding by MLA, AWI, NAB & ANZ that have enabled the program's core work. This research for this report has been made possible by funding provided by the CommBank. This project has greatly benefited from the leadership and experience of Rayne van den Berg, who is an experienced Chief Financial Officer and a global champion of Natural Capital Reporting. We gratefully acknowledge the wonderful work of Danny O'Brien to prepare the farm reports, and the assistance of Dr Steve Stewart and the CSIRO Perennial Prosperity project, and Dr Alex Maisey, Dr Jim Radford, Dr Fred Rainsford and Dr Grace Sutton of La Trobe University for the significant work in advancing techniques for modelling ecosystem services on farms. For our full list of partners see the About Us section of www.fff.org.au.



Commonwealth Bank



We also acknowledge the work of many other scientists whose work we have been able to draw on in the development of these approaches as well as the significant contribution of farmers, farm advisors, farm accountants, our industry partners, and our natural resource management partners. These have been very important in the project, and we have greatly enjoyed working with them.

Cover image credit: Imogen Semmler.

Disclaimer

This report has been prepared by the Macdoch Foundation's *Farming for the Future* project ('FFTF') for the purpose of assisting individual farm participants in the research project to understand the natural capital and environmental performance of their farms and to use the research findings prepared by FFTF.

The information contained in this publication are general statements based on this research and other published literature. FFTF advises that such information may be incomplete or inapplicable to some situations. This report and case studies associated with it use modelled data and data provided to FFTF by third parties, and whilst FFTF has exercised due care, skill, and diligence in preparing this report FFTF does not warrant the accuracy of data provided to it, or the accuracy of any conclusions drawn in reliance on the data.

The information presented in the report is based on experimental methods and emerging technologies. The information is not intended to indicate any causal relationships between natural capital and farm business performance. Considerably more farms are required in the dataset to derive such meaning.

This report does not constitute financial or investment advice and should not be relied upon for this purpose. To the extent permitted by law FFTF excludes liability for any loss or damage suffered by any person arising from or in relation to this report. Any person receiving this report holds FFTF harmless from any such liability.

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Executive summary

Farming for the Future (FFTF) is a world-leading agricultural research and change activation program. It was initiated by the Macdoch Foundation in 2021 in response to the increasing urgency for agriculture to play an active role as a nature-based solution to climate change and biodiversity loss, whilst continuing to produce high-quality food and fibre.

FFTF is building a broad network of collaborators across industry, government, academia and philanthropy. It ensures relevance through continual co-design of its research, outputs and engagement activities. In doing so it is building natural capital literacy and capacity to ensure that the Australian agriculture sector is ready to take advantage of current and emerging natural capital opportunities and mitigate future risks.

This economic benefits of trees on farms project was supported with funding from CommBank, a leader in sustainable financing of Australian agribusiness. It was designed to support Australian agricultural businesses on their path to net zero, and to support improvements to biodiversity, and farm business productivity, profitability and resilience. It invited farmers and farm advisors who participated in the FFTF Pilot Livestock Program to join in the exploration of how the economic benefits of trees on farms can be quantified in physical and monetary terms to make this value more visible in farm management and decision-making.

The project took a collaborative approach. It applied leading science by La Trobe University and CSIRO for the quantification of the economic benefits of trees on farms. It engaged a community of farmers and farm accountants as informed decision-makers about how the valuation of the contribution trees make to a farm business could be approached. It also engaged a community of property valuation and banking professionals to explore what would be needed to enable them to include the economic benefits of trees in their valuation of farmland.

Participating farmers were presented with very detailed reports quantifying the benefits trees were providing to their farm businesses, and information on what factors enhanced the value of trees in their livestock system. Along with farm accountants and advisors, they participated in two intensive workshops exploring how this information could be used to assign a monetary value to the trees as assets of the farm business and how farmers might advocate for this to be reflected in the property valuation. It also equipped the farmers with the research to advocate amongst other producers for the value of trees on farms.

Prior research has revealed that there is currently a general assumption¹ in the valuation community that the presence of woody vegetation such as remnant trees and shelter belts on broadacre farmland negatively impacts land value for several reasons:

- vegetation can reduce the productive capacity of that land due to physical obstacles, and
- grazing land with heavy tree cover may produce less pasture due to competition for water and nutrients.

However, as revealed in the FFTF research, trees on farms may be contributing positively to farm businesses. On average, farms with higher *Proximity*² scores were also more productive and had greater gross margins. But there were material differences based on a farm's location and type. Our interviews with farmers indicated that, to date, valuers and bankers had not requested information about farm shelter belts or natural capital on their farms nor how these investments might return improved financial performance to their business operations.

¹ MeasuringAustralianBroadacreFarmlandValue20191213_v.1.0.0.pdf

² Proximity is the degree to which production areas are close to wooded vegetation (including native and exotic trees, planted and remnant vegetation).

Our interviews with valuers revealed that they recognise the importance of farm natural capital in enhancing farm business productivity, profitability, and resilience; however, they require access to robust empirical information and capability building to interpret and apply natural capital metrics in farm valuations.

By contributing to the emergence of clear, quantified estimates of the value contribution of trees on farms, this FFTF-CommBank collaboration has helped unite financiers, valuers, and farm communities in a shared understanding of natural capital valuation, based on the role it can play in supporting future farm earnings potential and risk mitigation.

Further research is needed to expand the dataset to and get larger sample sizes needed for greater certainty and to extend the research to other regions and types of agriculture. This research reveals significant benefits of having these insights to inform effective strategies to improve productivity and build resilience in Australia's agricultural sector.

Collaborating for positive change

There is increasing urgency for agriculture to play an active role in solutions to climate change and biodiversity loss while simultaneously producing food, fibre and beverages and supporting the resilience of regional communities. It is estimated that 'natural climate solutions' that seek to mitigate carbon sequestration through the management of agricultural landscapes could contribute 15% of the total required to keep global warming below 2°C whilst simultaneously addressing issues around ongoing biodiversity loss and landscape degradation issues³.

For over 100 years, CommBank has proudly served regional and rural communities right across the country. It is committed to supporting Australia's transition to a net-zero economy by 2050 and is committed to supporting farmers through the development of solutions and services to deliver sustainable and profitable outcomes.

FFTF was initiated by the Macdoch Foundation in 2021 to develop and demonstrate research methods and outcomes that would reveal insights of where, when, and how natural capital management can improve business performance. It was supported with funding from philanthropy, Meat and Livestock Australia (MLA), and Australian Wool Innovation (AWI) to design and demonstrate this research for livestock producers.

In 2025, FFTF completed its Livestock Pilot Program. By collecting data on natural capital and farm business performance on 130 livestock farms in the Australian broadacre zone, the program has demonstrated that high-quality on-farm natural capital is positively correlated with higher levels of farm productivity, profitability, and resilience. The program found a particular influence of shelterbelts and other trees close to the productive areas on a farm, where vegetation and associated biodiversity can provide ecosystem services to livestock and nearby production areas. This influence was measured as a Natural Capital Index named "*Proximity*". For livestock systems, shade and protection from chill, and both cold and hot winds was a significant driver of benefits from *Proximity*.

The FFTF approach is essential because it recognises that not all farmers will be motivated to improve their natural capital purely for environmental reasons and many will not wish to participate in formal markets for carbon or nature repair. Surveys of farmers during the FFTF research suggests that productivity, profitability and business resilience are the strongest motivations for investing in natural capital, and that the direct effect of natural capital on core crop and livestock business performance is regarded as more compelling than access to new credit markets⁴. FFTF provides the evidence for these direct effects of natural capital on farm business performance.

CommBank has collaborated with FFTF to provide practical support to its customers and Australian farmers as they consider opportunities to invest in natural capital. Together we have executed a program of work to:

- support a profitable path to net-zero, improved biodiversity and improved farm business resilience,
- enable farmers to consider and manage trees alongside other farm assets for the benefit of the farm business, and
- liaise with farm accountants and property valuers to estimate the economic benefits their businesses receive from trees on farms.

The program leveraged recent research from CSIRO and La Trobe University and drew on specialised input from accounting and property valuation experts to develop methods that place a physical and monetary valuation on the economic benefits trees deliver to livestock operations. This report describes the key insights from the project. By making these insights available to other key actors in the agricultural space, including other banks and the supply chain, FFTF and CommBank are helping to build resilience in farming families, the agricultural sector, and the Australian landscape.

³ Griscom, B. W., Adams, J., Ellis, P. W., Houghton, R. A., Lomax, G., Miteva, D. A., ... & Fargione, J. (2017). Natural climate solutions. *Proceedings of the National Academy of Sciences*, 114(44), 11645-11650. doi:10.1073/pnas.1710465114/suppl_file/pnas.1710465114.sapp.pdf

⁴ FFTF. "Livestock pilot findings demonstrate natural capital boosts production, profit and resilience" Available at www.fftf.org.au/resources.

Outcomes from the *Farming for the Future* research – CommBank collaboration

Meeting global climate and biodiversity targets requires natural capital improvements to be delivered at scale. However, land use and land management change represent the cumulative impact of decisions made by individual landholders. This means that the positive changes required to meet global climate and biodiversity targets must be implemented farm-by-farm, and information about improving on-farm biodiversity must be delivered in a way that is relevant to farm-scale decision-making.

FFTF was designed in collaboration with industry partners to provide farmers with actionable insights on how they can utilise investments in their natural capital to enhance the performance of their farm businesses. A recent independent evaluation of FFTF⁵ found that the program is delivering on this objective: 77% of surveyed participants were able to identify natural capital actions that they could undertake to improve outcomes on their farm, and 100% of those respondents were likely or very likely to implement those changes over the next 12 months.

Modelling using the CSIRO ADOPT model (www.adopt.csiro.au) indicates that, by providing producers with empirical evidence about the financial benefits associated with natural capital on farms, FFTF could achieve natural capital improvement on an additional 38% of farmers in the Australian broadacre zone above baseline adoption levels. This means that, with continued stakeholder communication and engagement, the findings from the FFTF Livestock Pilot Program are likely to lead to natural capital improvements on 2,280 livestock farms within our focus study regions over a 7-year timeframe. If scaled to the broader extent of livestock operations in the Australian broadacre agricultural zone, FFTF could initiate natural capital improvements on ~13,000 livestock farms. Based on an average farm size of 2,500ha and an average increase in EBIT of up to \$100 per ha per annum (as observed for some farm types in the FFTF Livestock Pilot Program), this could provide an industry benefit conservatively estimated at \$3B per annum in additional farm profit (excluding upfront investment costs).

Investing in on-farm natural capital also brings public benefits. We estimate that improved natural capital could deliver the industry benefits described above whilst also delivering \$40B worth of biodiversity improvements over the next 20 years (as valued using market prices from the NSW Biodiversity Offset Scheme).

This FFTF – CommBank collaboration builds on FFTF successful delivery model, by providing participating farmers, farm accountants and property valuers with insights they need to identify opportunities for integrated tree plantings to support their core business. Participating farmers have received maps of the ecosystem services provided by plantings on their farm and a set of sample accounts quantifying the shade and shelter benefits these trees provide.

As part of this collaboration, FFTF and CommBank worked with farm advisors, bankers, land valuers, and others in the financial sector to build the capability and support for natural capital to feature in future formal business valuations and economic decision-making processes. We believe that once farmers are supported in investing in their natural capital, benefits will flow to farmers, the agriculture sector, and the Australian public at scale.

FFTF welcomes the opportunity to continue to collaborate with CommBank and others in the sector to support Australia's nature and climate targets and support Australian farm businesses. We aim to continue building the evidence and capabilities that farm businesses in all agricultural regions of the country need, to manage the risks of climate change and unlock the valuable opportunities their natural capital may hold.

⁵ <https://farmingforthefuture.org.au/wp-content/uploads/2025/03/FFTF-Systems-Impacts-Evaluation-Report-1-March-2025.pdf>

Introduction to natural capital in agriculture

Farming for the Future's research program aims to help build a better understanding of the relationship between the natural capital of a farm and the efficiency, productivity, profitability, and resilience of the farm business and the wellbeing of the farming family (Figure 1).

What is natural capital in agriculture?

Agricultural natural capital is the living parts of the farm - ecological assets like air, water, soil, plants, and animals. It represents significant ecological and commercial value and can be accounted for alongside agricultural assets like land, infrastructure, and livestock to provide a complete picture of a farm's assets.

Illustrated in Figure 1, the natural capital⁶ of a farm includes all the ecosystem types you would expect to see on a farm. For instance, remnant native vegetation, grassy woodlands, intensified pastures and cropping soils, shelterbelts, orchards and vineyards are all different types of agricultural ecosystems.

Agricultural and natural ecosystems provide a range of different ecosystem services that can support the production of crops and livestock. Depending on the types of natural capital it has and how they are arranged, a farm business can benefit from shade, shelter, forage for livestock, habitat for beneficial insects and birds that manage pests, soil biology that orchestrates plant needs for plant growth and disease and pest resistance, regulation of soil and water quality, water holding capacity of soil for moisture, and other services that support efficiency, profitability, and business resilience.

Natural Capital Generates Inflows (+ some outflows) of Economic Benefit

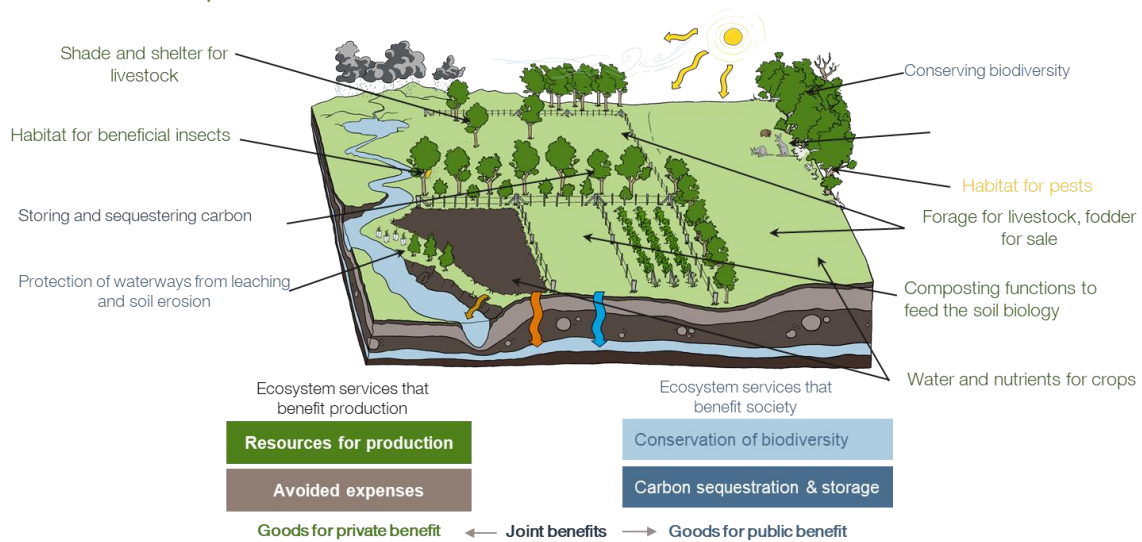


Figure 1: Overview of ecosystem services in agriculture. Different types of natural capital provide different types of resources that can benefit production (green) as well as providing benefits to society more broadly (blue). It is acknowledged that natural capital can also provide 'disservices' such as habitat for pests.

⁶ The term natural capital can also be referred to as ecological capital or ecosystem assets.

Farming for the Future focuses on measuring and valuing the benefits of natural capital on core farm performance, including productivity, profit, and resilience. Our work is designed to reveal opportunities for farmers to use and enhance their natural capital to uplift crop and livestock productivity, reduce expenses, reduce earnings volatility, and maintain access to premium commodity markets. This is in addition to any supplementary “non-core” income streams, which may also be available for farms to participate in the carbon and emerging nature repair markets via specific restoration or conservation projects.

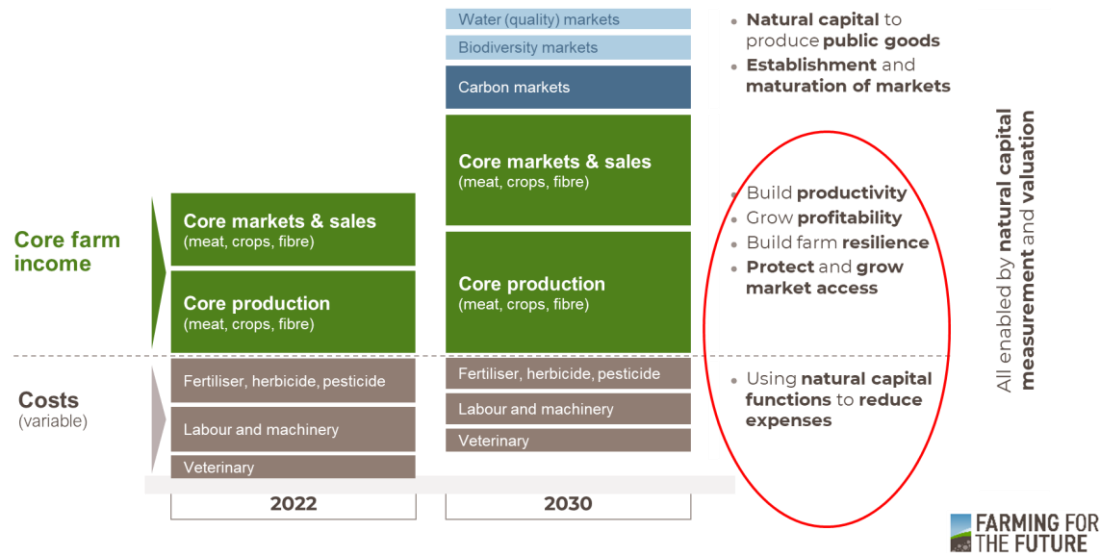


Figure 2: Illustration of the Farming for the Future focus (red circle) for its work on how natural capital supports farm business performance.

It is important that the contribution natural capital makes in agriculture is made visible in farm accounts, especially the balance sheet and in property valuations. A full picture of the assets of a farm, including the natural capital, enables the economic performance of the farm to be properly recognised and considered in business decisions (Figure 3).

Natural Capital in Agriculture

Natural capital underpins our economy, but is largely invisible in our accounting systems.

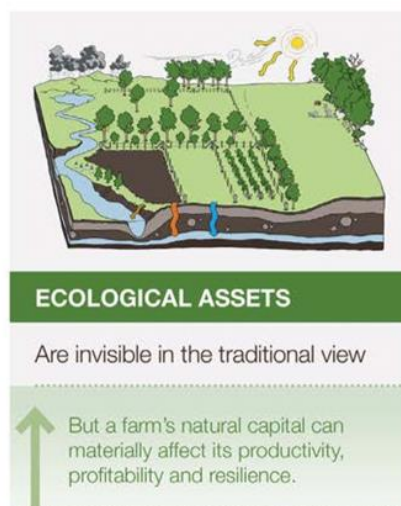
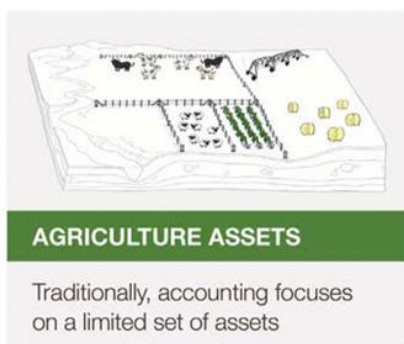


Figure 3: Natural Capital is not presently included in farm accounts. The inclusion of it would provide a more complete set of information about the assets of a farm and may assist with decision-making about farm business performance.

Overview | Shade & shelter services provided by trees

When trees are integrated into livestock production areas, they provide important ecosystem services to support livestock production. Integrated tree plantings are typically planted as either shelterbelts – rows of trees planted around the edge of crops or paddocks, or as paddock trees – individual trees or clumps of trees that are interspersed within the productive landscape. Each of these different types of planting will provide distinct ecosystem services. Recent research conducted by Peisley (2017)⁷, Keenan et al. (2023)⁸ and Stewart et al. (2024)⁹ is summarised below in Figure 4. See also the ANU Sustainable Farms Initiative¹⁰.

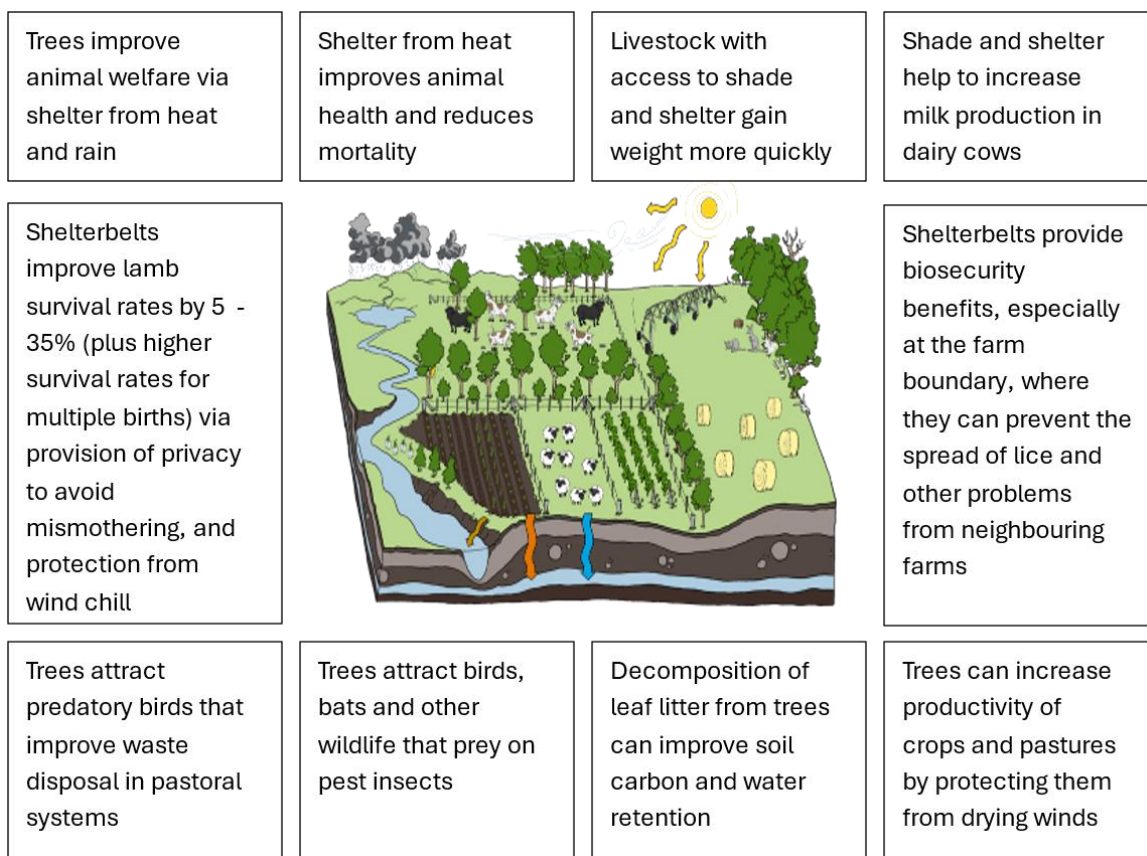


Figure 4: Selected ecosystem services provided by trees on farms

The contributions that trees make to a farm business can affect its performance in several ways such as by helping to avoid losses, avoid expenses, or generate extra yields. Ways to quantify the financial value of these may help farmers to develop a business case for investing in trees as natural assets of their farm business.

⁷ Peisley, R. (2017). The benefits and costs of bird activity in agroecosystems. Doctoral thesis. Charles Sturt University. The benefits and costs of bird activity in agroecosystems - Charles Sturt University Research Output

⁸ Keenan R, Meyer R, Stewart H, Sinnett A, Height K, Eckard R (2023) [Trees on Farm](#): Presentation at the ANZIF Conference

⁹ Stewart SB, Baker T, England JR, O'Grady AP, Brooks S, Mendham D (2024) Quantifying the shade, shelter, and productivity benefits of agroforestry systems on Tasmanian farms: Geospatial modelling at landscape-scale. CSIRO, Australia.

¹⁰ <https://www.sustainablefarms.org.au/on-the-farm/shelterbelts/>

Project approach

This project aimed to provide farmers, farm advisors, accountants and property valuers with some science, tools and resources they can use to estimate the contribution that trees are making to a farm business. It leveraged research conducted by CSIRO and La Trobe University and demonstrates the potential to quantify the contribution that trees are making to livestock businesses and to identify areas where investment in trees may further support the productivity and resilience of a livestock enterprise.

Farmers who participated in the FFTF pilot livestock research program were invited to participate in this work along with the farm advisor or farm accountant who had worked alongside them in the project.

Illustrated in Figure 5, participating farmers received detailed physical measures of how much shade and shelter are available on their farm and a summary of the predicted biodiversity (birds). They were also supplied with information on natural capital accounting approaches and encouraged to use this information to complement their own expertise and farm data to estimate the monetary value of the benefits the trees were providing as assets of their business.

Property valuers were engaged in a series of individual conversations and an online workshop to explore how the economic value of trees on farms could be reflected in the land valuation.

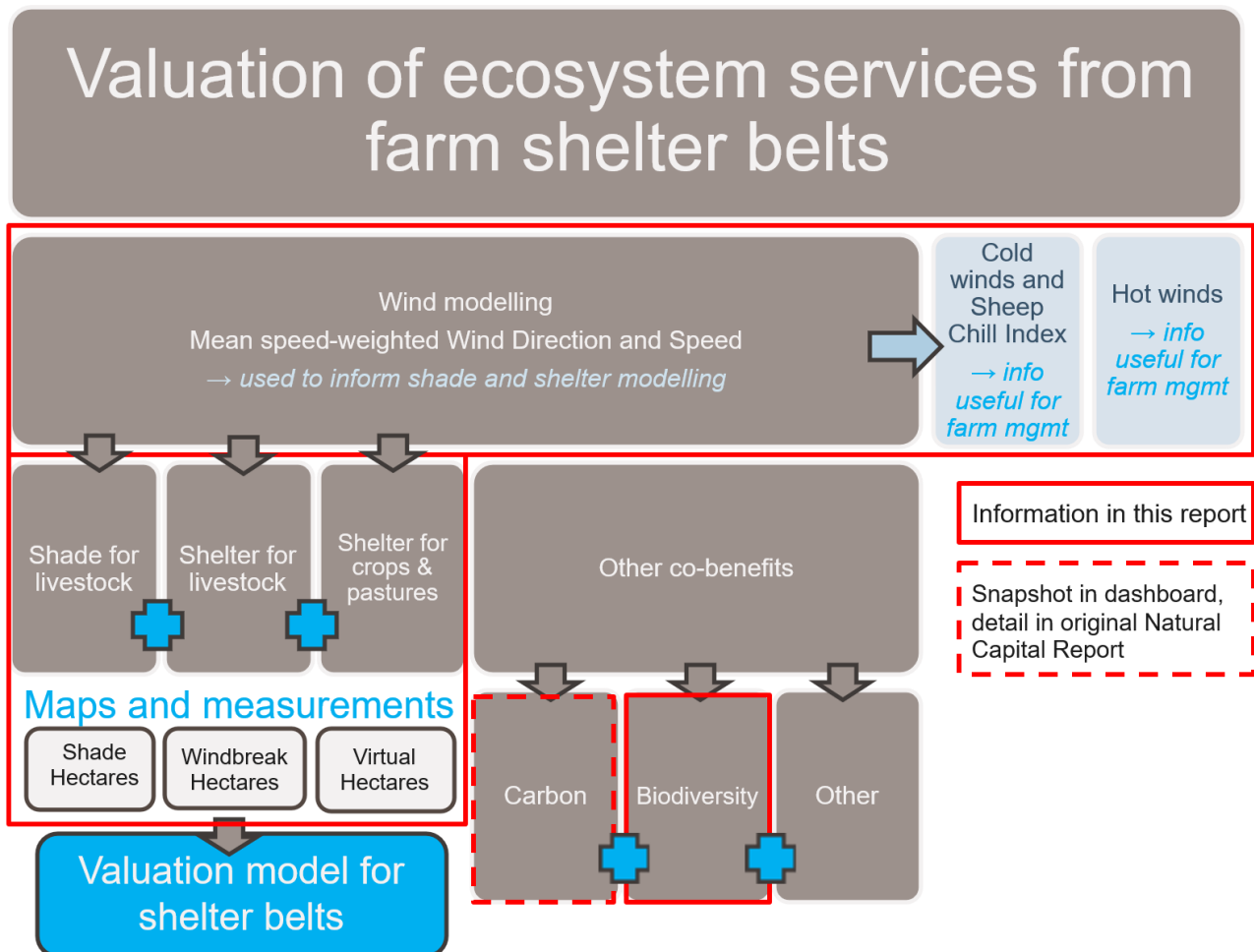


Figure 5: Illustration of information types and flows for this project. Indicated by the red boxes, the information provided in this report includes the modelled wind speed and direction and the maps for shade and shelter services from trees.

Benefits from trees for the Australian broadacre zone

The FFTF Livestock Pilot Program undertook detailed on-farm natural capital surveys that included measures of the extent to which vegetation has already been integrated into farm production activities via shelterbelts and other integrated plantings. This was measured using the natural capital index '*Proximity*'¹¹. Additional details regarding the calculation of FFTF's *Proximity* metric are provided overleaf and in the accompanying document that describes the key technical concepts¹² and also provided in the Resources section of the FFTF website¹³.

The FFTF Livestock Pilot Program identified positive relationships between *Proximity* and key farm performance indicators including production efficiency, livestock gross margin and earnings before interest and tax (EBIT). This means that integrated tree plantings are already improving profitability and are positively correlated with increasing profitability of Australian livestock farms, whilst also providing carbon sequestration and nature resilience benefits. The research also suggests that trees are associated with farm business resilience benefits in the form of greater stability of farm income¹⁴. This may be because the trees are improving crop, pasture and livestock productivity and also reducing the drying effect of harsh winds.

Scaling the findings of FFTF to all improved pastures across the Australian broadacre zone (45 million ha), we estimate the current value of natural capital in broadacre farming and provide indicative estimates of the productivity and economic benefits of investing in trees on farms Figure 6.

Farms with higher *Proximity* scores also performed highly on a second natural capital metric: Ecological Condition. Using metrics provided by the NSW Government's Biodiversity Market, we estimate that farms in Australia's broadacre zone currently support \$40B of biodiversity value to society.

Improving natural capital on farms can deliver



Conservative estimate of 2.5% increase in production efficiency⁺

Translating to improved profitability of approximately \$ 20 - \$100 per ha and increased levels of drought resilience



\$3 Billion p.a. benefit to farmers⁺

Across 45M ha of improved pastures in Australia's broadacre zone



\$40 Billion benefit to biodiversity ~

Doubling of habitat for 70% of bird species and >800 native plants including threatened species.

Figure 6: Estimated benefits to industry and society associated with improvements to natural capital on farms. +Farming for the Future, ~ La Trobe University FSNCA project, ^Based on market pricing from the NSW Biodiversity Offset Scheme, *CSIRO Adopt.

¹¹ Proximity is the degree to which production areas are close to wooded vegetation (including native and exotic trees, planted and remnant vegetation). The closer trees are to production areas, the more likely you are to gain benefits to farm production. See Key concepts section | Proximity for further information

¹² FFTF Farm Value of Trees Insights Report Key Technical Concepts August 2025. Available at www.fftf.org.au/resources

¹³ <https://farmingforthefuture.org.au/wp-content/uploads/2024/03/Natural-Capital-Methods-Paper-May-2024.pdf>

¹⁴ Further information about the benefits of natural capital for farm businesses are available on the resources page of the FFTF website <https://farmingforthefuture.org.au/resources/>

Key concept | Proximity

Trees provide important ecosystem services such as shade and shelter for livestock, crops and pastures and habitat for beneficial insects and animals that are predators of crop and pasture pests. The *Proximity* measure was developed to quantify the capacity of the trees on the farm to provide these inputs to the farm business. The closer production areas are to wooded vegetation, the more likely they are to receive benefits from shade and shelter for crops and livestock, as well as beneficial animals such as pollinators and predators of pests.

Our research found that farms with high levels of *Proximity* performed significantly better than farms with lower levels over the study period. For example, depending on the specific context, farms with higher levels of *Proximity* reported higher Gross Margin. Further information about the research can be found in the summary of the pilot livestock research available at <https://farmingforthefuture.org.au/wp-content/uploads/2025/05/Initial-findings-of-FFTF-Livestock-Pilot-2025.pdf>

Relationship between Gross Margin per hectare and Proximity

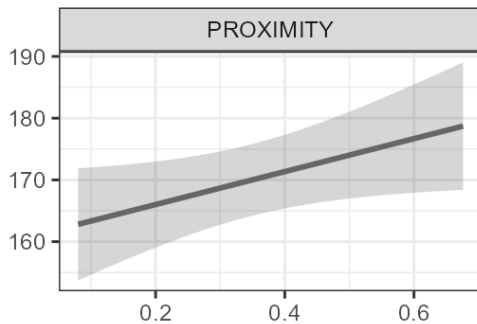


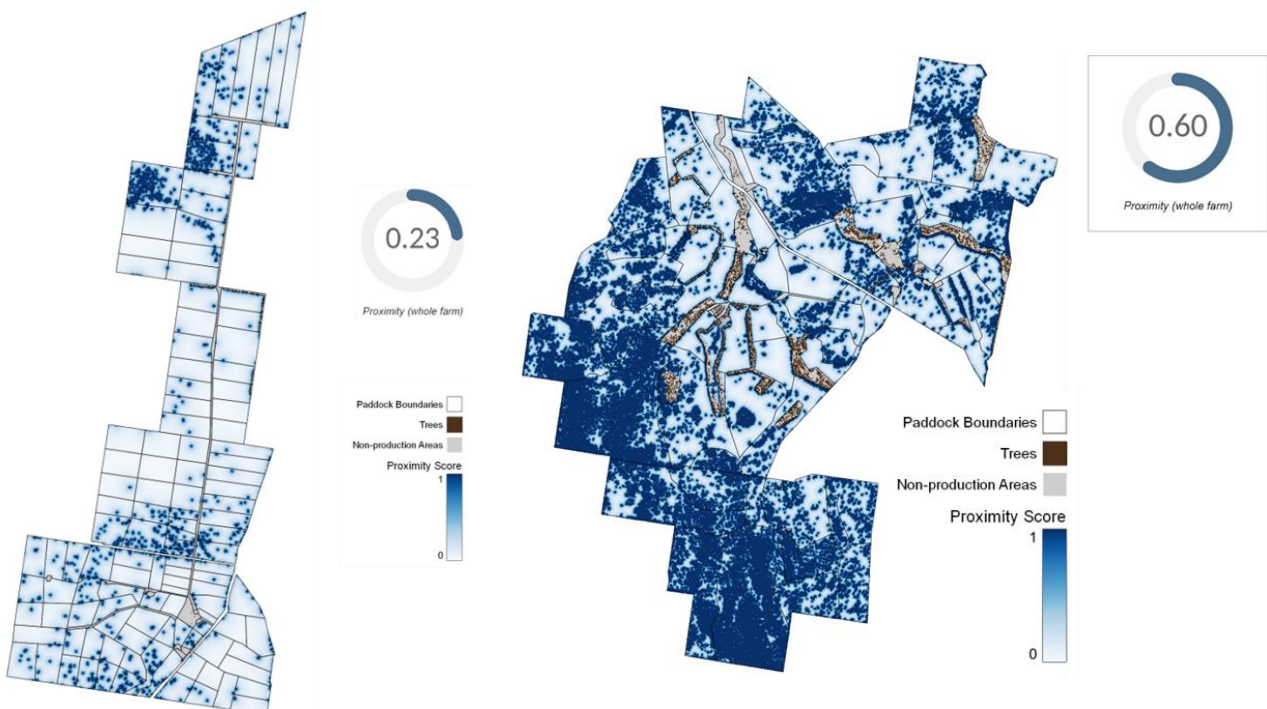
Figure 7: Graph showing moderate statistical evidence ($p=0.045$) of a positive relationship between gross margin of livestock enterprises and proximity for the whole sample, $n=111$. y-axis is \$ per hectare, x-axis is proximity score.

Proximity explained

Proximity is the degree to which production areas are close to wooded vegetation (including native and exotic trees, planted and remnant vegetation). A value of 1 would see nearly all areas of production within 10m of tree cover, whilst a value of 0 would see most areas of production more than 200m from tree cover. The closer trees are to production areas, the more likely benefits to farm production.

This index is a proxy for provision of ecosystem services such as shade and shelter.

The images below show two farms with contrasting Proximity Scores.



Making the insights actionable for farmers

This project was designed to provide participating farmers, farm accountants, and advisors with insights that they could act upon if they chose to. Farmers who participated in this project were provided with a detailed report about the shade and shelter benefits of the trees on their farms including a report of the habitat quality for birds. The report included an analysis of the dominant wind direction and information about extreme hot and cold days. The number of hectares of shade and shelter were quantified and shown on detailed farm maps to help farmers identify priority areas for planting trees.

Figure 8 shows an example of the 'dashboard' in the report provided to the participating farmers. The dashboard summarises the information provided in the detailed report to give farmers a snapshot for the time of the study and a set of useful information that they can use to track change over time. A complete example report is available on the FFTF website resources page.

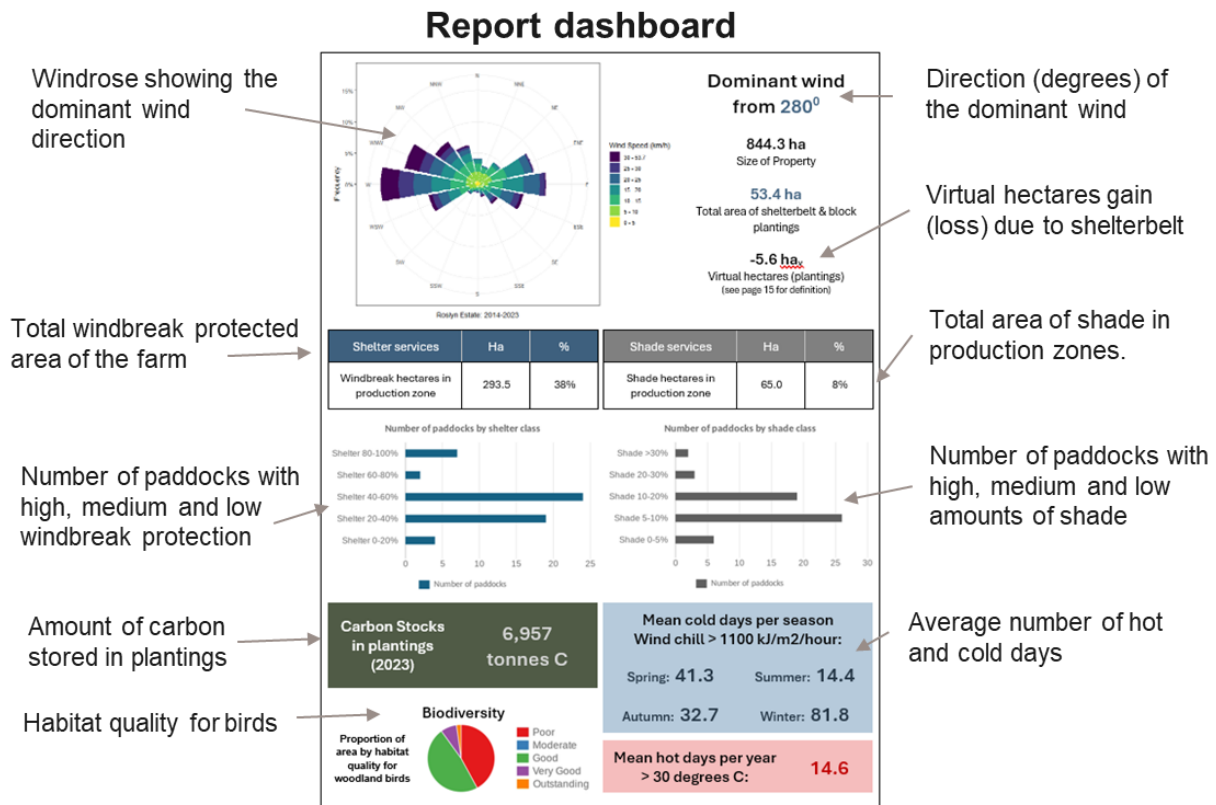


Figure 8: Example highlights dashboard prepared for farms that participated in the project. It summarises key information about shade and shelter benefits for livestock and crops. Detailed information was provided in the body of the farm reports.

Bringing integrated tree plantings onto the farm's balance sheet

Translating the measured benefits of shade and shelter and other ecosystem services from trees on farms into economic value, for example by differentiating the land value of those farms with better natural capital into higher agricultural land prices and ultimately onto farm business' balance sheets, would necessitate that these benefits could be valued in monetary terms and backed up with empirical evidence. This project conceptualises how this paradigm shift might start by illustrating the links between FFTF's research insights and how these could be incorporated into valuation approaches.

Monetary valuations of assets are based on estimates of the economic inflows they will generate, or the value of avoided losses or unmitigated risks.

Converting natural capital benefits into monetary values also aids in management decision-making and can help support business cases for further investment in tree-planting programs on farms.

Current approach to agricultural land valuations

During interviews with farmers, 70% indicated that their farms had been revalued within the last 5 years, primarily for bank refinancing purposes. Still, they experienced neutral or no impressions on the valuation process. They indicated that valuers did not request information about their farm's shelter belts, natural capital, or how these investments might contribute to improved financial performance in their business operations.

Equally, valuers shared during interviews that, to date, consideration of how natural capital might contribute to enhanced farm productivity, profitability, and resilience is rare. This is likely due to valuers' limited access to vital information and experience in interpreting and applying natural capital metrics to farm performance and farmland valuation.

There are several approaches and methodologies that a rural land valuer currently utilises to determine the value of agricultural land in Australia. The resulting value is usually influenced by one or more of the following factors:

- Data on recent comparable land sales in the same or similar district,
- Available data about the property and agricultural business performance,
- Seasonal conditions and current commodity market price trends,
- The capitalisation rate along with buyer motivation and locational advantages, and
- The valuer's experience and professional judgment.

A review of the Australian Property Institute and Property Institute of New Zealand's Technical Information Paper ANZVTIP 9 – Market Value of Rural and Agribusiness Properties, published in 2017, does not make any specific reference to ecological condition being a contributing factor in farm productivity, and makes only limited reference to natural assets:

“In the valuation of agricultural properties, the physical and environmental aspects of the property assume special importance. These include features such as climate, soil types, and their productive capability, the availability or absence of water for irrigation, and the feeding/carrying capacity for livestock¹⁵.”

There is currently a general assumption¹⁶ in the valuation community that the presence of woody vegetation, such as remnant trees and shelter belts, on broadacre farmland negatively impacts land value for several reasons:

- Vegetation can reduce the productive capacity of that land due to physical obstacles,

¹⁵20170427_anzvtip_9_market_value_of_rural_and_agribusiness_properties.pdf

¹⁶ MeasuringAustralianBroadacreFarmlandValue20191213_v.1.0.0.pdf

- Grazing land with heavy tree cover may produce less pasture due to competition for water and nutrients

However, they also acknowledged that the presence of woody vegetation could positively impact land value by providing ecosystem services, such as shelter from wind and extreme weather. Vegetation can also enhance farmland quality by reducing or preventing erosion and replenishing nitrogen in the soil.

Within the agricultural industry, a range of methodologies are currently utilised to determine value. These are summarised in Figure 9.

Direct comparison approach	Summation approach	Productivity approach	Income approach	Discounted cash flow (DCF) method
<ul style="list-style-type: none"> • subjectively adjust for the relative strengths and weaknesses of one property compared to another in recent sales data 	<ul style="list-style-type: none"> • separate values for different land class types, irrigation water entitlements, structural improvements such as dwellings 	<ul style="list-style-type: none"> • rate per unit of livestock able to be carried e.g. AE and DSE • Mostly used for intensive agri enterprises 	<ul style="list-style-type: none"> • likely future net return capitalised at a comparable yield • Rarely used in agri land valuation (more usual on commercial property) 	<ul style="list-style-type: none"> • model the expected income and net profit then convert into an acceptable purchase price, based on expected rate of return. • Usually, a check method due to the need to make assumptions around yield, commodity prices and operating expenses.

Figure 9: An overview of farm land valuation approaches.

During workshops, conversations, and interviews with farmers and land valuers, it became evident that the definition of valuation varied depending on the audience and their respective frames of reference. There was inconsistent language, definitions, approaches, and methodologies among the parties, sometimes causing confusion and mixed messaging. By providing clear, quantified estimates of the value of trees on farms, this FFTF-CommBank collaboration can help align financiers, valuers, and farm communities in a shared understanding of natural capital valuation based on the material role it can play in supporting future farm earnings potential and reducing the volatility of farm earnings during variable weather conditions.

How this CommBank project started to change conversations about potential future valuation approaches

The FFTF collaboration with CommBank aimed to support farmers, farm accountants, and farm property valuers to use FFTF's resources to update farmland valuation approaches by incorporating the findings from FFTF's research, substantiating natural capital productivity benefits from trees on farms into rural land valuations. It employed a Natural Capital Accounting (NCA) approach to estimate the economic benefits in both physical and monetary terms that trees provide to livestock businesses.

Natural Capital Accounting (NCA) aims to identify, measure, and value each separate and material ecosystem service and use this information to estimate the value of ecosystem assets that produce them.

The benefits trees provide to pastures, crops, and livestock, whether that be reduced costs, avoided losses, improved revenues/prices, extra yields, or lower price and/or input volatility, can be estimated by multiplying the biophysical quantity or metric by the unit value or value factor as summarised in Figure 10 below. From these, we can determine an ecosystem asset value (EAV) that represents the future economic flows the ecosystem (e.g., woodlands, shelterbelts, or scattered paddock trees) generates for them:

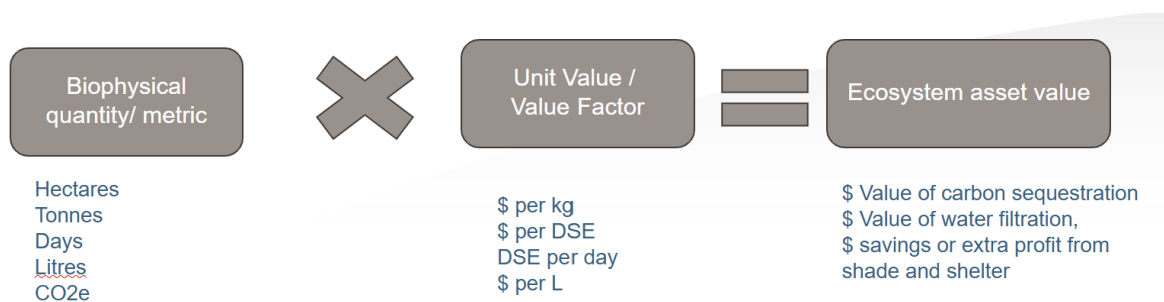


Figure 10: Estimating ecosystem service and asset values from biophysical metrics and monetary value factors.

The reports provided to participants in the FFTF CommBank project disclosed comprehensive insights to farmers on the physical values - the shade hectares, shelter hectares, and virtual hectares¹⁷ to aid better operational and strategic decision-making at the farm level¹⁸. This information is then combined with additional farmer insights specific to their farm and their management approaches to refine estimates of benefits that cannot be automatically modelled. These include variables such as:

- Baseline productivity of land under shelter belts – ridgelines vs valley
- Soil type
- Topography – slope and aspect, etc.
- Pasture types
- Rainfall and climate cycles
- Production system and management styles
- Livestock breeds
- Trade-offs and optionality

Participating farmers and farm accountants were presented with some worked examples of how they could use the measurements of shade and shelter services provided in their detailed reports and combine this with their expertise, local insight, and use a management accounting approach to estimate the monetary value of trees to the farm business. One example (Figure 11 overleaf) worked through some estimates of avoided loss of animal productivity due to heat stress. We then demonstrated how the value of shade can use these avoided loss benefits to estimate the value of the ecosystem services of shade for livestock (Figure 12).

¹⁷ Virtual hectares is an experimental concept designed to communicate the net productive gain or loss of crop or pasture yield that can be attributed to shelter from trees.

¹⁸ See the Key Technical Concepts report for further information.

Both examples applied the good practice of preparing a range of sensitivity analysis scenarios for consideration, allowing decision-makers to select the value that best represents the economic benefit generated by the asset for the business.

Scenario example is for a farm carrying around 4000 DSE that has **NO SHADE TREES** at all.

Value of shade services to avoid heat stress	Information source	Best case	Medium case	Worst case
Number of days >30°C	From report	60	60	60
Percent loss of animal performance due to heat stress if animals have no access to shade on >30°C	Farmer ¹ estimate	10%	30%	40%
Loss of Gross Margin per day per DSE ² <i>Av benchmarked gross margin per DSE of \$50/year</i>	Calculation	\$0.014	\$0.041	\$0.055
Estimated annual loss of potential gross margin due to heat (if there are no trees or shade on farm)	Calculation	\$4,468	\$9,937	\$12,982

If shade trees could prevent this loss totally, they would be worth:

- Highest estimate is \$12,982
- Lowest estimate is \$4,468

Having no trees may mean that the business is earning around \$9000 per year less than it could if all animals had shade on each >30°C day.

Figure 11: A worked example provided for a farmer and farm accountant webinar. The information in green-shaded cells is drawn from the individual farm report prepared for participants in the project. Information in blue-shaded cells is the farmer's estimate based on their specific situation.

How might shade service values be estimated?

		Best case	Medium case	Worst case
Estimated annual loss of potential gross margin due to heat (if there are no trees or shade on farm)	Calculation	\$4,468	\$9,937	\$12,982
Value of investment in shade trees				
Shade hectares available on property	From report	226		
% of productive areas with access to shade	From report	75%		
Percent of animals shaded by proposed trees	Scenario	80%	80%	80%
Value of trees in preventing loss of \$GM due to heat	Calculation*	\$3,895	\$7,789	\$10,386

Interpretation:

1. If the farm already has trees and they have the capacity to shade all animals, then this suggests the trees are contributing around \$7,000 per year to the business. [Avoided loss]
2. If the farm business is thinking about planting trees to increase the shade capacity, then this indicates a potential \$7k per annum profit benefit once established. To be used to determine Return on Investment against the costs of planting scattered paddock trees.

Figure 12: A worked example of how the monetary value of shade services might be estimated. The information in green-shaded cells is drawn from the individual farm report prepared for participants in the project. Information in blue-shaded cells is the farmer's estimate based on their specific situation. See the detailed technical report 'FFTF Value of trees on farms – Key Technical Concepts' for further information about the calculation of shade areas on farm.

This illustration of the annual benefit is a return on the upfront investment costs of planting more trees. This is aside from any other remuneration the trees could generate, such as via saleable carbon credits.

These valuation concepts can also serve as a working guide to prompt questions by valuers when assessing the value of rural land and the business's capacity to sustain future cash flows.

In addition to the worked examples provided above, base valuation formulas were proposed for four ecosystem services provided by trees on farms as modelled as part of this CommBank FFTF collaboration project, namely:

- Valuing the benefit of shade from heat stress on livestock weight gain/loss
- Valuing the benefit of shelter from cold winds on livestock weight gain/loss
- Valuing the benefit of shelter from cold on livestock survival
- Valuing the impact of trees on pasture productivity

An update to valuation practices will take time and patience to incorporate the empirical evidence being collated to substantiate the relationship between natural capital and farm performance, such as the findings from FFTF.

Confidence and trust in the proposed new approaches will continue to grow where price signals regarding future profitability and resilience, which are linked to natural capital indicators, are translated into realised property sale transactions that confirm market acceptance of the research findings and the positive relationships between future profitability and investments in environmental stewardship at the farm level.

Many agribusiness services firms and accountants who benchmark their clients' businesses can prepare reports showing comparative regional gross margins per hectare, unit costs of production, returns per paddock, and other key measurements to help establish baselines. The productivity uplift from ecosystem services could be applied to inform discounted cash flow models, adjusting land valuations with improved natural capital indices.

For example, the FFTF research suggests that for some farms, a significant portion of their gross margin (between \$20 and \$100 per hectare per year in the livestock operation) could be attributed to the ecosystem services delivered by trees (indicated by a high *Proximity* score). If we valued this as a type of ecosystem asset of a 4,000ha farm using a Net Present Value (NPV) calculation commonly used in valuations, the capacity for the trees to provide ecosystem services may be worth ~\$1 million as assets of the farm¹⁹. This level of due diligence information could support a natural capital-rich farm in achieving a sale price of \$1 million better. Sales events like this would then join other 'prior sales' information and start to drive valuation practices that account for trees on farms.

By using the insights and educational materials provided in this program, farmers, their advisors, insurers property valuers and their financial services providers can improve their understanding of how natural capital can support farm productivity, profitability, and resilience. They play a key role to play in starting to change the conversations and encourage the adoption of this research in their future management decisions.

This will assist banks and agricultural investors to factor natural capital into agricultural risk and opportunities assessments for their clients, and in doing so, strengthening their own brand whilst concurrently making better-informed risk and value decisions when allocating financial capital and targeting best practice future customers.

¹⁹ Using a rate of 6% and a period of ten years for a 4000ha farm.

Next steps and recommendations for future research

Expand the FFTF dataset for more confidence and wider insights

To provide farmers, their advisors, and bankers with locally relevant and higher-confidence insights into the economic benefits provided by trees to a farm business, the FFTF research, although the most extensive study of its kind in the world, needs to be expanded. The pilot livestock study has de-risked future research by demonstrating that the research itself is feasible, generates crucial insights, and that farmers and other stakeholders in agriculture find it useful and impactful. The lessons learned from the pilot phase can be reinvested in future research to help reduce the cost of research and enhance its value for farmers and others in the agricultural value chain.

Invest in research to confirm Australian estimates of shade and shelter benefits

The CSIRO research used in this study was prepared as a structured review of the findings of global research into the benefits of shade and shelter services on farms. This has been invaluable in laying the groundwork for advancing the field of natural capital accounting. However, global studies may not accurately reflect local conditions, and further research is needed to provide farmers, farm accountants, and property valuers with reliable and locally relevant valuations of ecosystem assets, including trees. This point was made strongly by farmers in workshops. They observed that some of the models prepared by CSIRO, for example, the area of the competition zone, did not match their local experience. They surmise that this is due to differences in rainfall, soil type, and tree type, but this needs to be tested with well-designed empirical research.

Support a community of practice for Natural Capital valuation

The field of natural capital accounting, although under intense development, remains relatively nascent, particularly concerning estimating the monetary value of ecosystem assets. An expansion of the FFTF research will assist significantly with this. In parallel, platforms must be developed to enable farm accountants and property valuers to access, interpret, and apply valuation strategies cost-effectively and reliably. We are aware of a significant amount of development for accounting practice underway, including considerations of sustainability in general-purpose financial reporting. This is important, but we firmly believe that making nature's value to the economy visible to the industry through mechanisms of value-in-use asset valuations may motivate rapid investment in natural capital at scale.

Continued promotion and advocacy of FFTF insights

Promotion of the FFTF insights and keeping the momentum and interest from this project will be instrumental in embedding these compelling insights into financial decision-making at scale across the broader value chain, using speaking and cross-promotional opportunities to reinforce messaging in professional networks, including:

- Australian Sustainable Finance Institute and the Australian Property Institute
- Australian Bureau of Statistics, ABARES, Department of Agriculture, Forestry and Fisheries
- National Farmers' Federation, NRM Regions, Landcare,
- Responsible Investment Association of Australasia, and Chartered Accountants of Australia and New Zealand
- Capitals Coalition and other communities of practice in natural capital accounting.

Leverage these insights

The following opportunities are highlighted as areas for embedding the advantages of these research insights, namely:

- Encourage valuers to consider farm natural capital and its connection to farm resilience and profitability in future report commentaries, while not dictating how valuers should conduct their valuations.
- Confidently understand this as a commercial opportunity for Australian agriculture
- Bring sustainability up in every conversation

- Be an advocate for engaging in transition due to the win/win/win for farmers, their businesses, and the planet
- Continue the learning journey – be curious
- Inspire others around this topic and opportunity

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