



awi Australian Wool
Innovation Limited

SUSTAINABILITY PROGRESS REPORT

Australian wool – best in the world and only getting better.



About Australian Wool Innovation

Australian Wool Innovation (AWI) is a not-for-profit enterprise that conducts research, development and marketing along the worldwide supply chain for Australian wool on behalf of about 60,000 woolgrowers who help fund the company.

Our mission is to make strategically targeted investments to enhance the profitability, international competitiveness and sustainability of the Australian wool industry. Funded by Australian woolgrowers, we are focused on delivering results for woolgrowers in line with the priorities identified through industry consultation and reflected in the company's strategic plan. Working along the supply chain of Australian wool, we nurture talent, innovate through research, and actively invest in pushing the boundaries of what wool means to the world.

OUR COMMITMENT TO SUSTAINABILITY

We are working to enable all stages of the wool supply chain to achieve sustainability goals and deliver positive outcomes for people, planet and prosperity.

Our sustainability ambition is:

- To dress the world in the most sustainable, circular fibre of the past, present and future.
- To support Australian woolgrowers profitably produce the world's most sustainable fibre, optimal for circular, traceable products.
- To position Australian woolgrowers as proactive, socially responsible and forward-looking stewards of the environment, building natural capital on their farms.



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About this report

The purpose of this report is to celebrate the outstanding sustainability programs, initiatives and achievements for the Australian wool industry across four areas over the past 20 years:

- Reducing climate impact
- Protecting ecosystems
- Thriving flocks and communities
- Understanding the life cycle of wool

Highlighting the collective progress of our industry showcases advancements in environmental and social outcomes and responsible best-practice embraced by woolgrowers. While these achievements are significant, we also acknowledge ongoing challenges woolgrowers face and the exciting opportunities to further promote their contributions to improving biodiversity, reducing climate impact and building resilience in their farms, communities and in nature.

This report provides an overview of recent initiatives, programs and outcomes, demonstrating how the industry is continuously building on insights from on-farm practices and research studies to maximise productivity and achieve positive outcomes for the environment, flocks and communities.



AUSTRALIAN WOOL INDUSTRY'S SUSTAINABILITY COMMITMENTS

In 2020, AWI supported the industry to launch Wool2030. This 10-year strategic plan for the Australian wool industry offers a roadmap for building on the strengths in our wool-growing heritage and community and tackling challenges to support a profitable, resilient and sustainable future for sheep and wool businesses.

Sustainability is the underlying principle of this 10-year plan by woolgrowers: in the careful management of animals and the land they occupy, and the wellbeing of woolgrowers and their customers, all of which are essential for resilience and sustained profitability.

The strategy focuses on five critical pillars for progress to 2030:

- Caring for our animals and the environment
- Marketing the world's most desirable fibre
- Communicating with our customers
- Transforming our production systems through innovation
- Fostering a prosperous wool-growing community

A message from our CEO



John Roberts
AWI CEO & The Woolmark Company
Managing Director

“Australian woolgrowers work hand in glove with nature. Their continuous commitment to the highest environmental and animal welfare standards presents opportunities for profound transformation that could see the wool industry move to the forefront of an international movement in sustainable and circular raw materials”

A longstanding tradition of natural resource management

Good natural resource management is not new to Australian woolgrowers; it is something they have been doing for decades. Having a deep understanding of and connection with their farm’s natural resources and a strong commitment to animal wellbeing is fundamental to productive wool-growing – it’s directly linked to their livelihoods.

Australian woolgrowers already undertake initiatives to protect, preserve and improve the natural resources on their properties for future generations. Furthermore, Australian woolgrowers comply with a range of industry audits and Australian and State environmental regulations covering topics such as animal wellbeing, chemical use, biosecurity, land clearing, biodiversity, pest animals and water allocations.

With governments, brands, and consumers all advocating for a nature positive future, there is now an additional opportunity for woolgrowers, and others in the value chain, to evidence and further develop their practices.

A promising future for wool

As a natural, renewable fibre that turns energy from sun, soil and plants into carbon storage, wool has a great deal to offer to a nature positive and circular future for textiles and fashion. Well-managed wool-growing farms have high potential for carbon sequestration and building natural capital, providing an opportunity for woolgrowers to play a lead role in decarbonising the fashion industry and fostering biodiversity. When these nature positive farms prosper, this not only supports resilience in their land, flocks and businesses, but also enriches and sustains rural communities.

Looking beyond on-farm and community benefits, wool promises to see our industry become a global ambassador for the benefits of sustainable and circular raw materials. Wool garments stay in wardrobes for longer and it is the textile most likely to be recycled. Science tells us that, when discarded, wool breaks down over time to return to nature. When compared with the extraction, waste and pollution of synthetic fibres, wool delivers clear advantages to brands and consumers looking to reduce the environmental impacts of fast fashion.

Driving innovation and best practice

Sustainability defies a one-size-fits-all approach – the same way nature cannot be put in a box. At AWI, our role is to equip woolgrowers with the necessary tools and research to make informed decisions that can be tailored to their unique businesses. Future opportunities continue to evolve, with new research helping woolgrowers to better understand, manage and measure risks, and build long-term resilience into their businesses. From pioneering projects evidencing and promoting the eco-credentials of the wool fibre through to novel ways to address methane emissions, these investments emphasise our industry’s commitment to a nature positive future, driven by innovation, stewardship and accountability.

These efforts are also enabling global brands to better understand and value nature positive practices in wool production and environmental management across the diverse Australian landscape. The industry is committed to transparently showcasing sustainability efforts through the Australian Sheep Sustainability Framework. AWI continues to undertake and publish comprehensive scientific evidence – from on-farm production through to end-product benefits – to help the wool industry establish and promote its environmental credentials in the marketplace. I firmly believe that our whole industry’s dedication to sustainability elevates the Australian wool industry as a global leader.

Key wins from these investments over the years are detailed throughout this report. Our entire industry has delivered measurable gains, with Australian woolgrowers now delivering even better environmental outcomes. By connecting sustainability goals along the supply chain and providing scalable opportunities, we seek to drive forward a prosperous, responsible and nature positive wool industry.

Australian wool industry impact highlights



Reducing climate impacts

50%

reduction in methane emissions from small trials grazing sheep when consuming methane mitigating feed additives.¹

1539 tCO₂e

average net carbon sequestration from 11 Australian wool-growing case study farms in the Natural Capital Accounting study.²

47%

of Australian sheep producers generating and using renewable energy.³



Protecting ecosystems

73%

of Australian sheep producers undertake deliberate activities to maintain, measure or enhance biodiversity on their property.⁴

89%

of Australian woolgrowers use multiple practices to encourage soil health.⁵



Understanding the life cycle of wool

Peer-reviewed studies have confirmed that wool is 100% biodegradable in soil⁶ and marine⁷ environments.

The wool industry completed the world's first textile fibre cradle-to-grave life cycle assessment (LCA) study taken through to peer-review.⁷



Thriving flocks and communities

925

days per year spent by shearing trainers in woolsheds nationally to reinforce best practice with new shearers and upskill existing shearers.⁹

>4,600

Wool-growing professionals have completed Lifetime Ewe Management training.¹⁰

31.4%

of Australian sheep producers pregnancy scan ewes for litter size.¹¹

¹ MERIL1 Progress Report (Milestone 3) by the University of New England, 15 June 2023

² Natural Capital Accounting Project Summary, wool.com, 2021

³ Sheep Sustainability Framework, National Producer Survey 2024

⁴ Sheep Sustainability Framework, National Producer Survey 2024

⁵ AWI Wool Industry Profile, May 2020

⁶ Collie, S., Brorens, P., Hassan, M. et al. Biodegradation behavior of wool and other textile fibers in aerobic composting conditions. *Int. J. Environ. Sci. Technol.* (2024).

⁷ Collie, S., Brorens, P., Hassan, M.M. et al. Marine Biodegradation Behavior of Wool and Other Textile Fibers. *Water Air Soil Pollut* **235**, 283 (2024). <https://doi.org/10.1007/s11270-024-07093-6>

⁸ Wiedemann et al, Environmental impacts associated with the production, use, and end-of-life of a woollen garment, *The International Journal of Life Cycle Assessment* (2020) 25:1486–1499

⁹ Sheep Sustainability Framework, National Producer Survey 2024

¹⁰ Sheep Sustainability Framework, National Producer Survey 2024

¹¹ Sheep Sustainability Framework, National Producer Survey 2024

Measuring progress and impact

In today's global market, businesses and their customers seek genuinely sustainable materials and finished goods. To ensure wool remains in demand now and into the future, our industry must continually demonstrate positive environmental and social impacts in wool production.

The following initiatives help our industry meet requirements for transparency and accountability whilst informing woolgrowers and others in the value chain on how to adapt their practices for better business productivity and sustainability. By establishing and sharing robust data at the individual farm and industry level, we can continue to demonstrate a responsible approach to wool production from farm to customer and beyond.

Initiatives

THE AUSTRALIAN SHEEP SUSTAINABILITY FRAMEWORK

Collaborators: WoolProducers Australia and Sheep Producers Australia, supported by AWI and Meat & Livestock Australia (MLA)

2021 – ongoing

Monitoring, measuring and reporting the industry's performance against key sustainability priorities, thereby demonstrating the industry's sustainable practices to stakeholders and building trust and confidence in the industry.

2024 Report highlights:

- 89.9% of sheep-grazing land in natural resource management regions is achieving healthy ground cover.
- 13.4% of sheep producers have undertaken carbon neutral or carbon accounting training.
- 91.9% of sheep producers use vaccinations to prevent disease and protect their flock.

NATURAL CAPITAL AND ENVIRONMENTAL PERFORMANCE MEASURES FOR AUSTRALIAN WOOLGROWERS

Collaborators: AWI and Farming for the Future

December 2023 – June 2024

Defining, in consultation with industry, a standard set of metrics for measuring and reporting environmental performance that are science-based and cost effective for woolgrowers to use, and provide greater clarity and certainty for brands and consumers.

Project outcomes

- Industry consensus on the definitions of nature positive in wool-growing.
- Standardised, commercially appropriate metrics.
- Guide technology and tool development to reduce cost of measuring performance and drive uptake.

SUSTAINABILITY REPORTING UPLIFT PROJECT

Collaborators: AWI and Australian Meat Processing Corporation

July 2023 – June 2025

Collating data required to verify Australian sheep and beef's agricultural credentials, with a focus on carbon, water and land indicators required under global standards.

Project outcomes

- Improved environmental transparency and market traceability to address global market demand and disclosure requirements.
- Expanding sustainability reporting capabilities for the wool and red meat industries.



Case study: Andrew Fowler – eco and financial benefits of looking after the land

The Fowler family has a combined farming area of 30,000 hectares in the Goldfields–Esperance region of Western Australia. The mixed farming enterprise comprises cropping on two thirds of the farmed land, and more than 40,000 sheep and 2,000 Angus cattle that graze on the remaining third. However, they're not the only animals around. Bushland is maintained in certain areas of the property, allowing native plants and wildlife to thrive.

"Bush was left in areas that were never going to be quite as productive, and they've become really important natural wildlife corridors. The bush on our farm links up with bush that extends for thousands of kilometres," said Andrew Fowler.

The family sees the ecological and financial benefits of looking after the land. "We farm in a way that is as sustainable as possible, both in synch with nature and trying to minimise our inputs and increase the fertility of that land," Andrew said.


By rotating between pasture, canola and wheat, one third of the farm at any one time is producing clover-based legumes, which serves to increase the organic matter in the soil. "One of the key things we look at is the soil's organic carbon levels, and we've been tracking it over the last 20 years," said Andrew.

As well as their pasture rotation, the Fowlers spread clay on vast areas of sandy soil, which acts to reduce erosion and allows vegetation to slowly begin to grow in areas where it was previously unseen.

Source: Woolmark.com www.woolmark.com/fibre/woolgrowers Accessed June 2024

01. Reducing climate impacts

- Maximising carbon sequestration potential
- Tackling methane emissions



Maximising carbon sequestration potential

As stewards of land producing a material that naturally stores carbon, woolgrowers have a significant opportunity to lead the way in providing nature-based solutions to the climate crisis. These efforts can strengthen their credentials as a provider of sustainable fibre and can also be a source of finance.

Wool-growing properties offer high potential for carbon sequestration. Carbon sequestration involves the capture, removal and permanent storage of carbon dioxide (CO₂) from the earth's atmosphere. It is a recognised method for reducing the effects of global warming caused by CO₂ and other greenhouse gases (GHGs). When CO₂ is stored in the natural environment, this is known as biological carbon sequestration.

Deliberate approaches to increasing carbon capture in soils and vegetation can boost a farm's natural assets and yield. This dual commercial opportunity offers woolgrowers both a key metric for sustainability credentials and as a commodity in the growing carbon market.

Accounting for carbon stored in wool

Wool fibre is 50% carbon which is stored for the life of the product. Under the current Greenhouse Gas Protocol, companies may report this temporary storage as 'additional information' but it cannot be included in carbon accounting due to the release of this carbon into the atmosphere at end of life when the fibre is either incinerated or decomposes.



Initiatives

CARBON STORAGE PARTNERSHIP

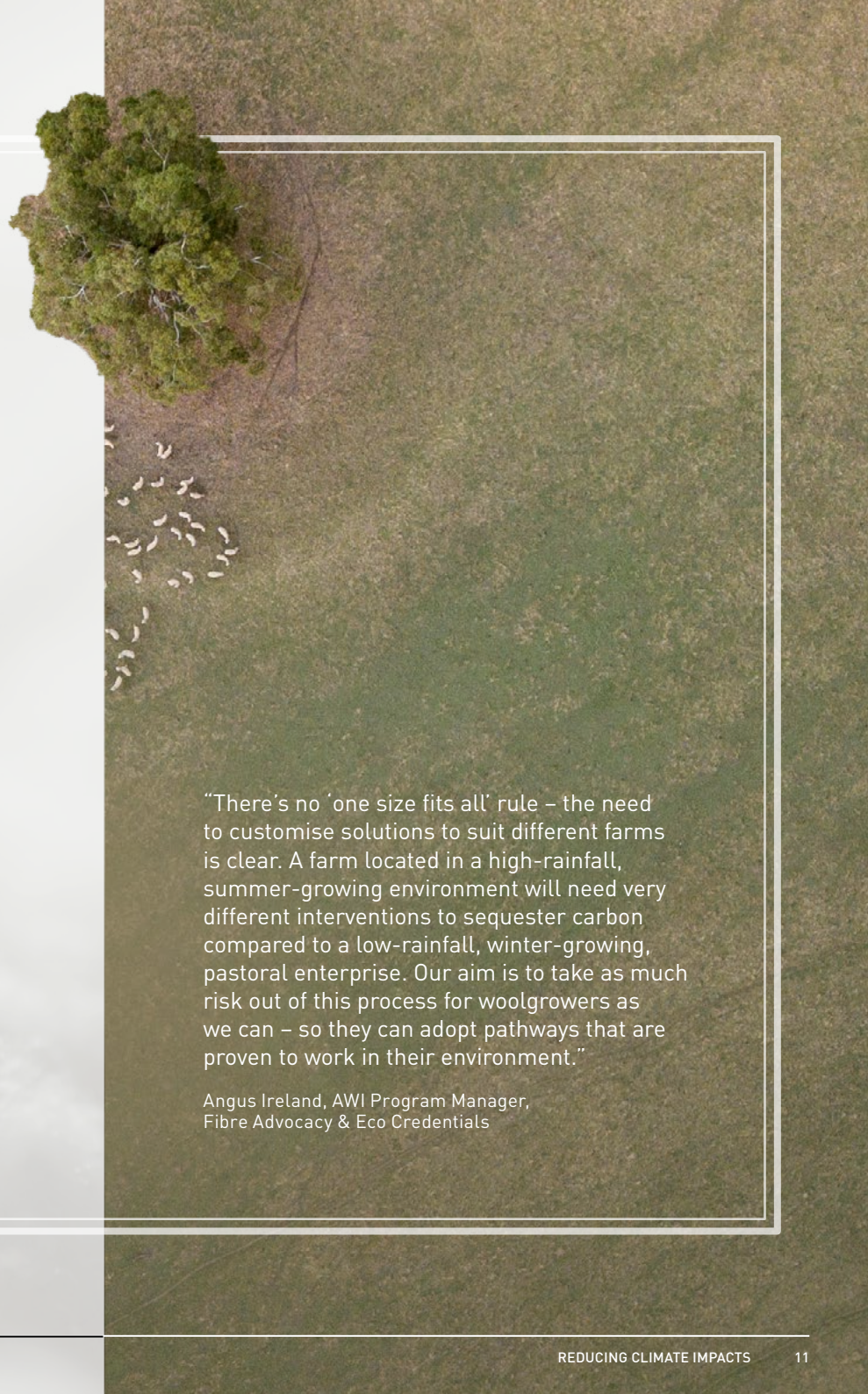
Collaborators: AWI and MLA with Carbon Storage Partnership members, UTAS and CSIRO

March 2022 – February 2025

Identifying the most effective, regionally relevant techniques woolgrowers can implement for sequestering carbon, improving biodiversity and natural capital on their farm. Modelling of on-farm interventions has begun and case studies developed.

Project outcomes

- Identify effective and appropriate techniques for woolgrowers to reduce GHG emissions, build biodiversity, and improve productivity and profitability.
- Position the Australian wool industry as environmental stewards who are using socially and environmentally responsible approaches to land management.



“There’s no ‘one size fits all’ rule – the need to customise solutions to suit different farms is clear. A farm located in a high-rainfall, summer-growing environment will need very different interventions to sequester carbon compared to a low-rainfall, winter-growing, pastoral enterprise. Our aim is to take as much risk out of this process for woolgrowers as we can – so they can adopt pathways that are proven to work in their environment.”

Angus Ireland, AWI Program Manager,
Fibre Advocacy & Eco Credentials

Case study: Cameron Wood – solar grazing at New England Solar



RENEWABLE ENERGY

At a national level, the transition to renewable energy has been identified as the most important lever in achieving Australia's net zero by 2050 target. Along with others in the agricultural industry, sheep producers are getting on board with renewables. According to the Sheep Sustainability Framework Annual Report for 2024, 47% of sheep producers are generating and using renewable energy from solar or wind¹². Others are taking up opportunities to co-locate their livestock on land dedicated to renewable energy projects.

Solar grazing is the practice of livestock, usually sheep, grazing the land on which solar farms are located. It is an example of dual land use, one that provides fibre and meat from the sheep, but also renewable energy.

More than 6,000 sheep now graze at one of Australia's newest and largest solar farms, with early indications pointing to a win-win for wool-growing and renewable energy production. New England Solar, developed by ACEN Australia and situated 6km east of Uralla in NSW, once fully completed, will provide enough clean renewable power for about 300,000 homes.

The panels rotate east-west throughout the day as they track the sun to maximise the amount of energy produced. The panels also provide the sheep with protection from the sun and shelter from rain.

Superfine woolgrower Cameron Wood is the fifth generation of his family to run sheep on the land, which has been in the family for about 140 years.

"It's been really exciting for us to first see the solar panels on the land to help us drought proof our operations, and then to bring the sheep back to the land to feed under the panels," Cameron said. "The fresh grass and shade are a great combination – the sheep just look really happy. We're looking forward to getting them in the sheds this winter for shearing, and their wool baled up for market."

Source: Beyond the Bale, June 2024



¹² Sheep Sustainability Framework Annual Report 2024

Tackling methane emissions

While the burning of coal, oil and gas is the dominant source of the world's GHGs, the agricultural sector – including wool-growing – can play a pivotal role in the solution, with innovative projects reducing methane emissions and enhancing productivity. Through cutting-edge research and collaboration, the wool industry is setting new standards in methane mitigation, demonstrating a strong commitment to a greener future.

Biogenic methane from sheep are a significant part of on-farm GHG emissions. It breaks down into CO₂ after about 12 years and is then recycled by plant photosynthesis. Although methane is part of the natural carbon cycle, it is included in the current metrics for reporting carbon emissions.

Reducing emissions intensity, as well as reducing total emissions, are primary focus areas for the Australian wool industry. Emissions intensity can be reduced by increasing flock productivity, which also importantly supports better financial results in farming enterprises. Reducing methane emissions from enteric fermentation is also being thoroughly researched and trialled via innovative solutions such as feed additives, supplements and low methane genetics.



Flock productivity

Initiatives

IDENTIFYING PATHWAYS TO LOW GHG WOOL

Collaborators: AWI & MLA

February 2020 – August 2022

Exploring new pathways toward low emission wool and continues to explore viable mitigation strategies and model future emissions and economic impacts based on potential adoption rates for these strategies.

Project outcomes

- Identifying total emissions and emission intensity over time for the national Australian sheep flock.
- Comparing national-scale emissions using a range of GHG metrics for determining the impacts of methane.
- Identifying opportunities at the farm and national scales for managing and minimising emission sources.

¹³ Sheep Sustainability Framework Annual Report 2024

¹⁴ Sheep Sustainability Framework Annual Report 2024

LIFETIME EWE MANAGEMENT (LTEM)

Collaborators: AWI

2005 – ongoing

Increasing woolgrowers' knowledge and understanding of the influence of ewe nutrition and management on overall reproduction rates and lamb and ewe survival.

Project outcomes

- On average, course participants report an increase in stocking rate of 9.3%, increase in marking and weaning percentage by 7%, and a 25% reduction in ewe mortality.
- More than 4,600 wool-growing professionals have completed Lifetime Ewe Management training to date.¹³

MERINO LIFETIME PRODUCTIVITY PROJECT

Collaborators: AWI & Australian Merino Sire Evaluation

2015 - 2025

Gathering and analysing genetic and economic data from five sire evaluation sites in Australia to better understand how current selection and breeding approaches support lifetime production of high-quality wool, lambs and meat from different types of Merino sheep.

Project outcomes

- Improved predictability of early in life visual and breeding value assessments to better reflect their lifetime performance.
- Add-on projects will lead to advances in breeding for higher profitability per hectare and resilience and lower methane.

PREGNANCY SCANNING

Collaborators: AWI, MLA & University of Adelaide

June 2019 – February 2023

Evidencing the value of pregnancy scanning, with the main benefit being that it enables sheep producers to better meet the nutritional requirements of ewes of different litter sizes, including empty ewes, thereby increasing marking rates.

Project outcomes

- Research showed pregnancy scanning has a high return on investment for sheep producers.
- Scanning for multiples increases potential profit by an average of \$5.55 per ewe scanned and provides twice the value of scanning for pregnancy status only.
- 31.4% of Australian sheep producers pregnancy scan ewes for litter size.¹⁴

Case study: Ben Banks – pregnancy scanning improves productivity



Wool producer Ben Banks from Blackall in Queensland believes introducing a pregnancy-scanning program is an investment that can lift flock fertility by 10 to 15 per cent annually and help fine-tune ewe management.



Ben and his wife Oona manage a 46,500 hectare family property, 'Rivington', where they run 25,000 Merinos when the season permits. For close to a decade the couple have also operated a contract pregnancy-scanning business, processing around 100,000 head of sheep annually. Ben has also used pregnancy scanning as an integral part of his own operation to lift production and in turn bolster profitability.

"I think scanning is one of the most under-utilised resources especially in central-western Queensland, where there is so much potential for improving management of pregnant ewes," Ben said. "Central-western Queensland is a harsh pastoral environment, but by identifying pregnancy status, we can tailor nutrition and husbandry management programs so we end up marking more lambs."

He said pregnancy scanning also allowed producers to draft ewes into mobs of multiple or single bearing ewes, as well as culling infertile animals, which improved flock efficiency and ensured feed was being utilised by the most productive animals.

"Twinning ewes can be run in smaller mobs and fed to meet their extra nutritional requirements. Meanwhile single ewes can be run in larger mobs and dry ewes can be run like wethers or sold," he said.

Within his own operation, Ben has become increasingly focused on scanning for multiple pregnancies, so more productive ewes were managed effectively to ensure they delivered lambs on the ground.

Source: Beyond the Bale, September 2019

Trialling methane-mitigating feed additives

Woolgrower-funded research has identified feed additives for grazing sheep as having significant potential to reduce wool's emissions footprint. Studies in both cattle and sheep show that additives such as Bovair, Asparagopsis (Red Algae) and essential oils lead to significant reduction in methane emissions. This AWI research, led by the University of New England (UNE), is exploring the most promising methane mitigating additives for grazing sheep, the best ways to deliver the supplements to grazing sheep, as well as productivity and safety. The goal is to identify win-win solutions that reduce methane while also improving productive performance. AWI is co-funding five projects that have received funding through the Australian Government's Methane Emissions Reduction in Livestock (MERiL) Research Grants.

Initiatives

METHANE MITIGATION FROM GRAZING SHEEP USING RED ALGAE (ASPARAGOPSIS)

Collaborators: AWI & UNE

July 2021 – June 2024

Measuring the relationship between intake of Asparagopsis supplement and methane mitigation for grazing sheep, considering factors including pasture quality and type, and frequency of supplement delivery.

Project outcomes

- Early results show a 50% average methane reduction in grazing sheep flocks consuming Asparagopsis, via pellets.
- Twice daily supplementation has been shown as optimal for sustained methane abatement in grazing sheep.

DELIVERY AND EFFICACY OF ANTI-METHANOGENIC ADDITIVES IN GRAZING SHEEP

Collaborators: AWI, UWA & PIRSA

July 2021 – June 2025

Evaluating delivery mechanisms for the commercial additive Agolin® Ruminant and a water-soluble and stabilised bromoform formulation, for enteric methane mitigation in sheep.

Initiatives

RADIO-FREQUENCY IDENTIFICATION (RFID) TO ASSESS AND REFINE DELIVERY SYSTEMS FOR ANTI-METHANOGENIC ADDITIVES

Collaborators: AWI & NSW DPI

June 2023 - June 2024

Defining the feasibility of a 'lick feeder' and 'loose lick feeder' as delivery mechanisms for anti-methanogenic feed additives using Agolin® Ruminant and RFID hardware.

A DELIVERY SOLUTION FOR GRAZING SHEEP

Collaborators: AWI & UNE

October 2023 - June 2024

Investigating a unique delivery system for grazing to deliver doses of anti-methanogenic feed additives to individual sheep in flocks of up to 800 sheep based on RFID tag technology.

A NATIONAL APPROACH TO SHEEP METHANE MITIGATION

MERIL 3.1

Collaborators: AWI, UNE, UWA & PIRSA

November 2023 - June 2026

This project aims to deliver an improved estimation of emissions from grazing animals that receive anti-methanogenic additives and assess their longer-term impacts on productivity.

Project outcomes

- Understand the potential of additives to reduce methane emissions from grazing sheep.
- Determine impact of additives on animal productivity, safety and reproductive performance.
- Demonstrate the wool industry is responding to governments, brands, and consumer concerns about methane emissions.

MERIL 3.2

Collaborators: AWI, UNE, UWA, PIRSA & NSW DPI

November 2024 - March 2027

This project will validate the performance additives that are close to market-ready and likely to improve the methane abatement and productivity of sheep.

Project outcomes

- Assess the performance of combinations of additives on methane abatement and productivity Identify most effective delivery mechanisms to grazing sheep across Australia's differing production systems and environments.
- Provide continued evidence of a proactive wool industry, responding to government, brand and consumer concerns about methane emissions.

02. Protecting ecosystems

- Biodiversity: benefits and initiatives
- The value of natural capital
- Soil health and pasture management




Biodiversity

For Australian woolgrowers, biodiversity and natural resource management are essential to business success. For generations their practices have demonstrated commitment to the principles of ecological balance, enabling them to protect the natural environment while achieving strong economic outcomes.

Examples of these practices include:

- Grazing management: Implementation of rotational and phase grazing in natural pastures.
- Tree management: protecting and boosting natural woody vegetation and establishing shelterbelts and wildlife corridors.
- Soil management: maintaining adequate ground cover and minimum tillage.
- Water resource management: protecting farm dams and riparian zones between natural water sources and farmland, creating and conserving wetlands.



A landmark study on natural resource management conducted by AWI in 2002-07 revealed that 90% of woolgrowers considered natural resource management to be important and were already using sustainable management practices.¹⁵

¹⁵ Land Water Wool, 2007



Initiatives

LAND, WATER & WOOL

Collaborators: AWI and the Australian Government, plus 39 other research, educational and extension partners.

2002-2007

The Australian wool industry's most significant R&D investment in natural resource management, demonstrating that biodiversity enhancement has been at the forefront of Australian woolgrowers' practices long before it became part of the global sustainability vernacular.

Project outcomes

- Findings revealed many woolgrowers are already generating a profit while enhancing biodiversity on their properties.
- They do this through choosing an appropriate grazing system, monitoring native pastures, retaining native vegetation and establishing shelterbelts, and protecting riparian zones and creating wetlands.
- As a result, diversity of native plants and habitats is retained, providing the foods and shelter needed to maintain local wildlife populations.



AUSTRALIAN PASTURES GENE BANK

Collaborators: AWI, other Research and Development Corporations & government

2013-present

The Australian Pastures Genebank (APG) was established in 2013 and operates under the framework of the International Treaty on Plant Genetic Resources for Food and Agriculture. The APG collects, collates and stores seed and associated data from eleven significant collections of temperate and tropical pasture and forages from around Australia. The seed is distributed domestically and internationally to support science research, education and the development of new varieties to benefit producers and sustain and enhance agricultural productivity and environmental preservation.

Case study: John and Isabelle Atkinson – farming in a biodiversity hotspot



'Maitland' – John and Isabelle Atkinson's 2,000 hectare farm near Campbell Town in Tasmania – is rugged country. The property is situated within the Tasmanian Midlands – a nationally recognised 'biodiversity hotspot' and one of Australia's most biologically rich, yet threatened, natural areas. Some two-thirds of John and Isabelle's farm is comprised of native vegetation. These remnants provide important refuge for a range of threatened species.

John and Isabelle spend considerable time and resources proactively managing their farm for conservation. A significant portion of their budget is spent controlling gorse, a major environmental weed. Small areas of the property, such as creek lines, are fenced off and revegetated, and the vast majority is carefully grazed for both production and environmental outcomes.

The Atkinsons believe that grazed land needs a recovery period to remain viable. Stocking rates are kept low. Most of the native vegetation is spelled for three months over the spring and summer period, to give the grass time to flower, seed and reproduce. Vegetation and salinity are monitored to ensure that grazing is not having detrimental effects. If there are signs of overgrazing, the land is destocked accordingly.

Managing their land to support conservation is a no-brainer for John and Isabelle. Farming with a conservation focus, which also maintains healthy, viable grazing land, provides them with peace of mind and assurance of the long-term sustainability for their business. They feel there are also clear animal welfare and well-recognised financial benefits. "It's almost guaranteed to aid production," said Isabelle.

Source: Farming for the Future case study, July 2023



Measuring natural capital assets

With growing interest from brands and consumers in selectively sourcing wool from sustainable farms, work continues to enable woolgrowers to report their eco-credentials to the market. The focus is on maximising market interest in wool, while also reducing the burden on farmers in terms of cost and time.

AWI's research partners at La Trobe University and Farming for the Future are overcoming these challenges by leveraging advanced satellite imagery to cost-effectively measure on-farm natural capital metrics such as ground cover, tree cover, shade and shelter, and greenhouse gas sequestration.

Natural capital is an economic metaphor referring to the natural resources and ecosystems that provide essential services, such as soil health and water quality. Natural capital accounting measures and values these assets, helping woolgrowers understand the environmental benefits of their land. As a complement to financial measures of capital assets and profit, natural capital accounting can give a broader view when looking at farm returns.

Tracking changes in natural capital over time and monitoring the relationship between farming practice, environmental impact and business performance can help woolgrowers make better decisions on investments and practices to support biodiversity, soil health and carbon capture. This is why natural capital has become a major focus for the wool-growing industry in recent years.



Initiatives

NATURAL CAPITAL CASE STUDIES

Collaborators: AWI & Vanguard Business Services

2020

This project carried out a baseline natural capital audit across 11 Australian wool-growing properties in 2020, using objective measures for each property's environmental assets including soil, water, biodiversity and vegetation to understand how natural capital contributes to financial performance over time.

Project outcomes

- More than 30,000 ha of grassy woodlands and native pastures across the 11 farms.
- Ground cover recorded ranged from 75% to 100% - higher than regional averages.
- The farms captured and stored a net 1,539 tonnes of CO₂e/year, on average.

FARMING FOR THE FUTURE

Collaborators: AWI, Macdoch Foundation & MLA

2022-2024

Findings and recommendations to support woolgrowers in making investments in on-farm natural capital that target both environmental and economic returns, with the ultimate goal of building resilience, productivity and profitability into their businesses.

Project outcomes

- Make clear the costs and productivity benefits of investing in on-farm natural capital.
- Provide practical guidance on embedding natural resource measurement in farm management practices.
- Develop tools that offer information to woolgrowers to support business planning and decision making, with specific insights on biodiversity.



Initiatives

THE IMPACT OF PASTURE BIODIVERSITY AND GRAZING MANAGEMENT PRODUCTIVITY, GHG EMISSIONS AND PROFIT

Collaborators: AWI & UTAS

2024

Examining cell grazing duration, stocking rates and rest periods as well as pasture diversity, modelled over the long term and accounting for more than 100 years of real climatic conditions, to determine their impact on carbon, GHG emissions, production and profit.

Project outcomes

- An enhanced understanding of the impact of pasture biodiversity and grazing management on pasture productivity, GHG emissions and profit.

ENHANCING CLASSIFICATION OF FARM-SCALE NATURAL CAPITAL ASSETS USING REMOTE SENSING

Collaborators: AWI, La Trobe University, Farming for the Future & Integrated Futures

2024-2026

Aiming to help Australian woolgrowers more easily and cost-effectively provide high-quality environmental data about their farm to the supply chain by enhancing the capability of remote sensing technology to better and more efficiently classify on-farm natural capital assets.

Project outcomes

- Improve uptake of accounts for best-practice natural capital accounting and sustainability reporting in agriculture.

Case Study: Michael Taylor – natural capital accounting helps understand profit



Natural Capital accounting, which considers the contributions that a property's natural assets make to the farming business, has helped woolgrower Michael Taylor of Kentucky in NSW to get a deeper understanding of his family farm's profit.

"With our land making up more than 80% of the value of the business, natural capital accounting is very useful as it enables us to clearly see the value of the ecosystem services and the biodiversity on the property, including our pasture health, tree growth across the property and our net carbon sequestration," Michael said.

'Taylors Run' is managed as an integrated agroforestry system. Since the late 1970s, the Taylors have planted more than 250,000 trees on the property, increasing tree cover from less than 5% to more than 20%. More than 60 hectares across the whole farm are managed for commercial production each year.


"As well as providing shelter and shade to the livestock and wildlife, our trees also reduce the loss of soil moisture when it's windy. We aim to spread shelter evenly across the property, so it is a patchwork of forest and reserves and pastured areas," Michael said.

"As shelter increases, we're seeing increased biodiversity, including more than 122 different species of birds recorded on the property."

The Taylor family encourages healthy soils and pastures. "We aim to maintain 100% ground cover for 100% of the year, to best utilise all intensities of rainfall at any time of the year," Michael said.

Source: Beyond the Bale, September 2021





Soil health and pasture management

For woolgrowers, soil health plays a critical role in supporting both sustainability and yield in wool production. More than any other farm asset, investing in soil health develops the capital woolgrowers need for their flocks and business to thrive, now and for generations to come.

Findings from an AWI survey of 1000 woolgrowers¹⁶ shows how our industry is already making significant investments in practices to support soil health.

89% of woolgrowers surveyed are implementing multiple practices to boost soil health

83% actively maintain ground cover


74% routinely conduct soil tests

72% practice rotational grazing

65% adopt no-till cropping

50% sow deep-rooted perennials

¹⁶AWI Wool Industry Profile, May 2020



Initiatives

EVERGRAZE

Collaborators: AWI & MLA

2004-2014

Developing and launching a new farming system to help woolgrowers access the benefits of perennial pastures including increased ground cover, reduced weeds and soil loss and pasture resilience through native and sown perennials.

Project outcomes

- Engaged about 12,000 farmers and more than 6000 service providers.
- Delivered more than 630 training events.
- Prompted practice change on more than 4400 Australian farms, impacting more than 900,000 hectares.

FILLING THE FEED GAP WITH SHRUB SYSTEMS

Collaborators: AWI, MLA & CSIRO

2018-2023

Exploring new shrub systems including saltbush to increase woolgrowers' climate resilience, fill the late summer/early autumn feed gap and make unproductive agricultural land more profitable.

Project outcomes

- Identified elite saltbush seed lines that produce at least 50% more biomass and have similar nutritional value to the current industry best practice shrubs.
- Developed information regarding shrub grazing management and fertilisers to assist producers to optimise system productivity.

DRYLAND LEGUME PASTURE SYSTEMS

Collaborators: AWI, Grains Research Development Corporation & Department of Agriculture, Water and the Environment (now known as Department of Agriculture, Fisheries and Forestry)

2017-2022

Developing novel hard-seeded legume species aimed at increasing species adoption in the low and medium rainfall areas of southern Australia.

Project outcomes

- The developed legumes offer producers a low-cost, resilient pasture option that can regenerate from a large, robust seedbank in the soil.



Woolgrower Colin Seis from Gulgong in the Central Tablelands of NSW

Case study: Colin Seis – a pasture cropping pioneer

Woolgrower Colin Seis from Gulgong in the Central Tablelands of NSW and his neighbour Daryl Cluff developed a new technique they call 'pasture cropping' that involves sowing crops into living perennial pastures and growing them in combination, so that the cropping and grazing benefit each other.

"Pasture cropping enables integration of sheep and crop production, optimising production of both while minimising chemical inputs and machinery use and improving soil structure and fertility," Colin said.

"While conventional cropping methods require that all vegetation be killed prior to sowing and while the crop is growing, with pasture cropping there is no need to kill competing ground cover vegetation, and yet adequate productivity can still be achieved.

"Ground cover is maintained at all times which makes the paddocks more resilient to drought, wind and water erosion are avoided, soil structure is not destroyed by cultivation, and chemical input requirements are only a fraction of those used in traditional crop production methods."

Sowing a crop using the pasture cropping method also stimulates a diverse variety of perennial grass seedlings, which had sat dormant in the soil, to grow in high numbers. This then produces more stock feed after the crop is harvested and totally eliminates the need to re-sow pastures.

Sheep are an intrinsic part of Colin's pasture cropping system. The change in farm and soil management has restored the farm and soil ecosystems, which more than doubled soil carbon, significantly improved soil water holding capacity and increased soil nutrient levels. The restored farm ecosystem has increased the property's carrying capacity and profit and significantly reduced the cost of farm inputs of fertiliser and pesticides.

Source: Beyond the Bale, December 2018

03. Thriving flocks and communities

- Animal wellbeing
- A safe, sustainable and productive workforce
- Industry innovations



1. Animal wellbeing

Australian woolgrowers know that happy, healthy sheep produce the world's best wool. The lifetime wellbeing of sheep is the number one priority for all woolgrowers.

For woolgrowers, ensuring sheep wellbeing is an investment in both the productivity and social licence wool-growing businesses need to succeed. Awareness amongst customers, consumers and governments concerning animal wellbeing is driving preferences for wool products coming from farms where animal wellbeing is verified.

The industry has a long history of investing in animal wellbeing research, development and extension to ensure best-practice and provide more sustainable and humane solutions to common pests and diseases, improving lifetime health and wellbeing outcomes for Australian sheep flocks.

Initiatives

OPTIMISING CHEMICALS TO COMBAT PARASITES

Collaborators: AWI, MLA & Research Organisations

Ongoing

Researching chemical use for more effective management of current parasite treatments and the development of new alternatives, with the overarching aim to ensure woolgrowers have access to effective chemical treatments to improve the lifetime welfare of sheep.

Program outcomes

- ParaBoss: An AWI and MLA co-funded online resource offering comprehensive information on prevention and treatment of sheep parasites.
- Other research and development projects investigating flystrike prevention alternatives include nanotechnology, fly genome sequencing, Sterile Insect Technique and a Flystrike vaccine.

FLYSTRIKE MANAGEMENT AND PREVENTION

Collaborators: AWI

2021 - ongoing

Available to woolgrowers across Australia to improve the lifetime welfare of their sheep, reduce their reliance on mulesing and crutching, optimise chemical use and increase whole farm profitability.

Program outcomes

- One-day workshop for woolgrowers offering knowledge and skills in strategies for more natural and profitable flystrike resistance.

- One-day workshop helping woolgrowers develop a property-specific flystrike management plan.
- Flystrike Genomics Reference Flock – aiming to increase phenotypic and genomic information needed to establish a flystrike Australian Sheep Breeding Value (ASBV).
- Publications including the visual sheep score booklet for woolgrowers.
- Toolkit for woolgrowers to help them prepare for and manage high risk flystrike periods.

Initiatives

ANALGESIA AND ANAESTHESIA

Collaborators: AWI, research institutions & pharmaceutical companies

2006 - 2016

Development and promotion of effective and practical analgesia and anaesthesia to improve sheep welfare during husbandry procedures such as mulesing, tail docking and castration.

Program outcomes

- 89.7% of Merino woolgrowers provide appropriate pain management when mulesing.¹⁷

¹⁷ Sheep Sustainability Framework Annual Report 2024

NATIONAL WILD DOG ACTION PLAN

AWI, Producer Representatives, State and Federal Governments, MLA, USQ, CISS, WoolProducers, SheepProducers, AHA; Cattle Australia & National Farmers Federation.

2014 - ongoing

Historically, wild dog attacks have been a major threat to sheep survival and productivity. As part of the National Wild Dog Action Plan to coordinate effective and humane management of wild dogs, woolgrowers have been involved in initiatives to both control wild dogs, undertake further education and training, and maintain and develop best practice controls to protect their flocks from wild dog attacks.

Project outcomes

- The long-term (2014-2022) average reduction in losses to predation due to AWI Community Wild Dog Control Initiative (CWDCI) and other "On-Ground" support, averaged 81%.

IMPROVING LAMB SURVIVAL BY OPTIMISING LAMBING DENSITY AND MOB SIZE

AWI & MLA

2016 - 2019

Providing best practice guidance on the effects of mob size and stocking rate on lamb survival across different breeds, environments and management conditions on commercial farms, thereby providing welfare and productivity.

Project outcomes

- Demonstrated that lambing ewes (particularly multiple-bearing ewes) in smaller mobs contributes to improved lamb survival on commercial farms across southern Australia.
- Developed best practice recommendations for lambing ewes that have been integrated into extension activities and materials such as Lifetime Ewe Management and Making More From Sheep.



A safe and sustainable workforce

Providing woolgrowers and wool industry professionals with access to training and education programs and resources is a vital investment in the enrichment of rural communities and prosperity for the broader industry. Through workshops, leadership initiatives and improved safety measures, the industry showcases rewarding careers in wool and supporting current and future generations with the skills and knowledge to secure a sustainable and profitable future for Australian wool.



Initiatives

SHEARER AND WOOL HANDLER TRAINING

Collaborators: AWI

Ongoing investment

Making progress on safety, efficiency and ease of wool harvesting is a high priority for the wool industry to help prevent injuries, support sheep welfare, attract new talent and keep people working in the industry for longer.

Project outcomes

- 81% retention rate of novice and intermediate wool harvesting employees following participation in training.
- Supporting improvements in skills, career longevity, safety and wellbeing for the wool workforce, as well as better business outcomes for woolgrowers.

SECURING FUTURE TALENT FOR WOOL-FOCUSED CAREERS

Through education, innovation and leadership programs for students and early career professionals, the Australian wool industry provides opportunities for young people to develop their skills and career pathways in wool.

Breeding Leadership: A five-day industry-specific leadership skills course for young people, completed by 219 aspiring wool industry leaders to date.

Scholarships: Nuffield Farming Scholars, Peter Westblade Scholarship for aspiring leaders, Horizon Scholarship for agricultural and vet undergraduates.

School Merino wether challenges across SA, NSW, QLD, TAS, VIC and WA, with more than 1,200 students taking part in 2022.

SHED SAFETY INITIATIVES

- AWI Learner Shearer Toolbox in partnership with Heiniger.
- Safesheds safety program and signage kit.
- Shearing shed design considerations guide.
- Wearable tech to measure muscle fatigue and shearing injuries.

Industry innovations

Successful farms and producers are the lifeblood of Australian rural communities. There is continuous investment in research and innovation to support productivity across the wool industry. New technologies for wool harvesting offer solutions that can reduce risks for shearers and sheep and improve quality and yield in wool output.

Initiatives

WOOL HARVESTING INNOVATION DEMONSTRATIONS

Collaborators: AWI

2023

New wool harvesting technologies, such as the AWI Sheep Delivery Unit that delivers sheep directly to the shearer, thereby eliminating the catch and drag from the pen, minimising the chance of injury to the shearer and the sheep, whilst also maximising productivity.

Project outcomes

- 100 units of the AWI Sheep Delivery Unit are now in use across every wool-growing state in Australia.

BIOLOGICAL WOOL HARVESTING

Collaborators: AWI & University of Adelaide

March 2023 – May 2025

Researching a new opportunity for biological harvesting of wool that generates a weakened zone at the base of the wool fibre but, importantly, enables the fleece to remain on the sheep without a net until the wool can be mechanically removed.

Project outcomes

- Improved animal welfare and wool quality by eliminating skin pieces, second cuts (thereby resulting in even fibre length) and creating slightly reduced fibre diameter at the tips.
- Minimised health and safety issues with no need for sharp handpieces, and reduced animal handling injuries through use of upright platforms or conveyor belts.



04. Understanding the lifecycle of wool

- Lifecycle assessment
- A circular fibre for the future



Life cycle assessment

Life cycle assessment (LCA) is an international standard for reporting on the negative environmental impacts of products and processes. LCAs do not yet account for positive environmental impacts, an area of current investigation for the wool industry.

Initiatives

CRADLE-TO-GRAVE LIFE CYCLE ASSESSMENT FOR WOOL FIBRE

Collaborators: AWI & International Wool Textile Organisation

2020

The wool industry delivered the world's first peer-reviewed textile fibre cradle-to-grave LCA that looked at every stage of a wool garment's life cycle, including the use phase and end of life which previous wool LCA studies had not done.

Project outcomes

- Detailed information about the environmental and resource impacts of wool production, use and disposal.
- Showed that the number of times a garment is worn is the most influential factor in determining garment impacts.
- Indicates consumers who are aware of wool's attributes have the largest power to influence the sustainability of their wool garments by maximising the active garment lifespan and therefore reducing overall impacts.

Wool garments have the lowest water and energy use per wear.¹⁸

¹⁸ Global Wardrobe Study, The Woolmark Company x Nielsen, 2018

Case study: Chris & Tarlee Atkinson – farming eco-credentials inspire new brand



Chris and Tarlee Atkinson run about 5,000 superfine Merinos across two properties, one in the Adelaide Hills and one in Kangaroo Island, totalling 1,865 hectares.

But the Atkinsons are not only woolgrowers; in 2022 they created their own brand, Modern Merino, selling scarves, wraps, blankets and throws using wool grown by their own sheep. In the brand's marketing, the Atkinsons highlight that the wool in their products is grown alongside nature on their farm.

Chris says the core values on their farm have always been focused on looking after the native flora and fauna, and treating all animals domesticated or not with respect and care.

“For example, 23% of our Kangaroo Island property consists of native bushland which we do not graze; it is left entirely to the native flora and fauna. And on our Adelaide Hills property, we have planted thousands of native trees and shrubs, and fenced off 30-hectares of waterways and gullies to prevent erosion and provide homes to the native fauna,” Chris said.

“We also have a fenced-off 30-hectare bush block, which is one of the few remaining natural areas in the eastern Adelaide Hills. We often receive visits from various government, university, and private organisations to view and monitor the rare flora on the block. Both properties are home to thousands of native birds, animals and reptiles which are all fully protected.”

The property is carefully managed with rotational grazing and the Atkinsons very carefully manage wildlife and conservation corridors of native forest and scrub on their property.

Source: Beyond the Bale, June 2023



A circular fibre for the future

As consumer demand continues to grow for sustainable, traceable products, brands are being challenged to provide lower impact fibres and fabrics in a bid to reduce their reliance on fossil fuel and emissions. The wool industry has an opportunity to meet this demand with a readily recyclable and regenerative fibre from nature, safeguarding global market access for wool as the premium, circular fibre of choice.

Initiatives

BIODEGRADATION BEHAVIOUR OF WOOL AND OTHER TEXTILE FIBRES IN AEROBIC COMPOSTING CONDITIONS

Collaborators: AWI & AgResearch


2018 - 2020

Examining the biodegradability of different fibre types in industrial composting conditions, carried out in accordance with ISO14855-1 Determination of the ultimate aerobic biodegradability of plastic materials under controlled composting conditions.²⁰

Project outcomes

- Both untreated wool and machine-washable wool were found to biodegrade readily in terrestrial environments, and synthetic fibres were not.

²⁰ Collie, S., Brorens, P., Hassan, M. et al. Biodegradation behavior of wool and other textile fibers in aerobic composting conditions. *Int. J. Environ. Sci. Technol.* (2024).



Wool garments are 300% more likely to be donated compared to garments made of other major fibre types.¹⁹

¹⁹Russell, S., Swan, P., Trebowicz, M., Ireland, A. (2016). Review of Wool Recycling and Reuse. In: Fangueiro, R., Rana, S. (eds) *Natural Fibres: Advances in Science and Technology Towards Industrial Applications*. RILEM Bookseries, vol 12. Springer, Dordrecht. https://doi.org/10.1007/978-94-017-7515-1_33

A circular fibre for the future

Initiatives

MARINE BIODEGRADATION BEHAVIOR OF WOOL AND OTHER TEXTILE FIBERS

Collaborators: AWI & AgResearch

2018 - 2020

Examining the biodegradability of different fibre types in a marine environment, with residues examined using scanning electron microscopy and energy-dispersive X-ray spectroscopy.²¹

Project outcomes

- Both untreated wool and machine-washable wool were found to biodegrade readily in marine environments, and synthetic fibres were not.
- No evidence that the Hercosett resin used as part of the machine-washable wool treatment forms microplastic pollution was found.

HOW CHEMICALS IMPACT COMPOSTING

Collaborators: AWI

2023

Comparing composting performance of different knitted and woven Merino apparel fabrics treated with chemical processes during production, including dyeing, bleaching, stain-repellence, and shrink resist.²²

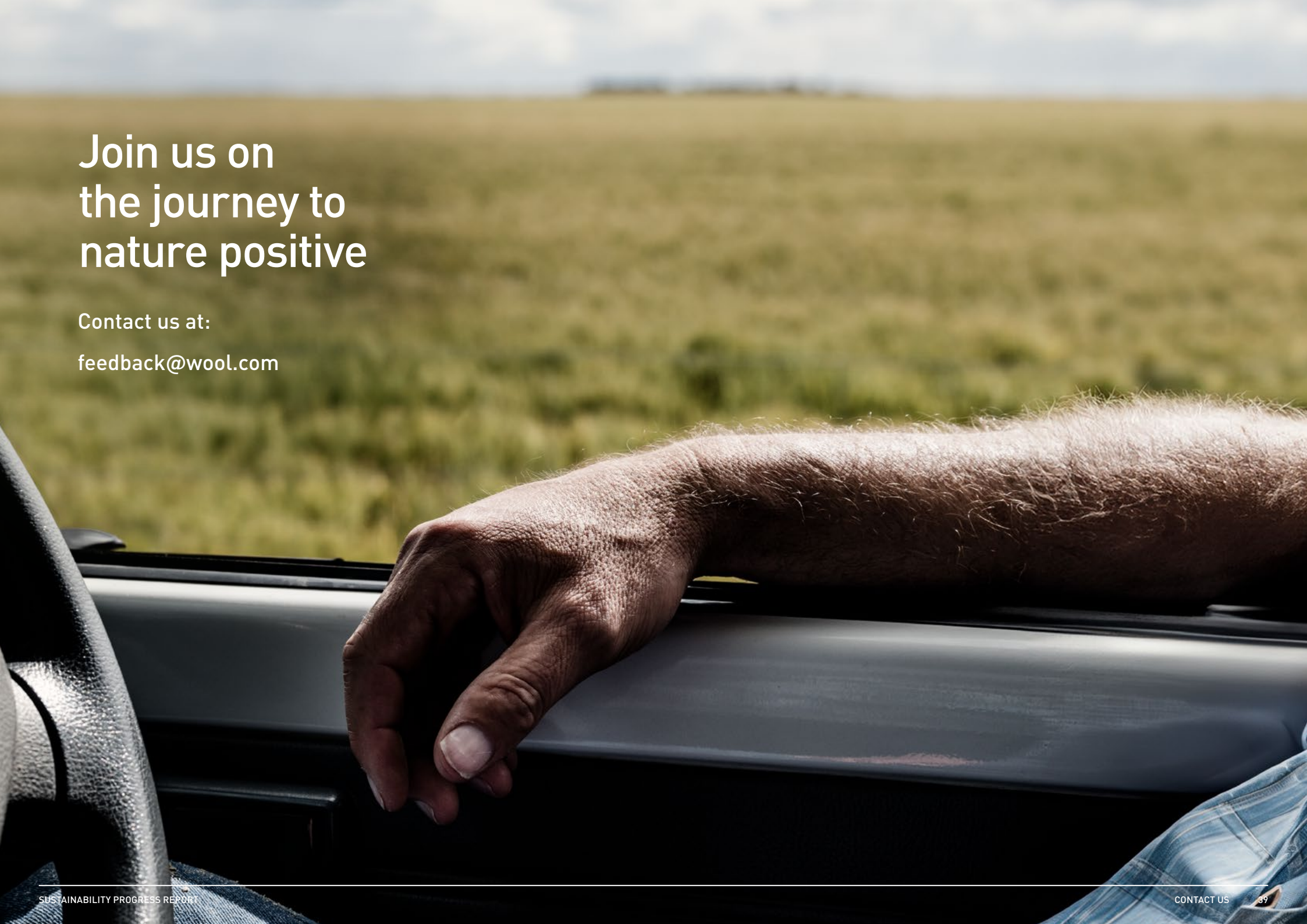
Project outcomes

- Chemical processing of wool fabrics does affect onset of composting during soil burial, although the effect is typically small and transient.
- Of the 11 samples, nine exhibited mass losses after only four weeks' burial.

Wool is the most recycled apparel fibre in the world, supported by a well-established and commercially viable recycling industry.

²¹Collie, S., Brorens, P., Hassan, M.M. et al. Marine Biodegradation Behavior of Wool and Other Textile Fibers. *Water Air Soil Pollut* 235, 283 (2024). <https://doi.org/10.1007/s11270-024-07093-6> Wiedemann et al, Environmental impacts associated with

²²Hodgson A, Leighs SJ, van Koten C. Compostability of wool textiles by soil burial. *Textile Research Journal*. 2023;93(15-16):3692-3702. <https://journals.sagepub.com/doi/abs/10.1177/00405175231163590> doi: 10.1177/00405175231163590



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