LINCOLN
UNIVERSITY
TE WHARE WĀNAKA O AORAKI

Sustainable Development Goals Report 2023

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He matapaki nā te Tumu Whakarae
Vice-Chancellor's Review

Tēna koutou

Welcome to our 2023 Sustainable Development Goals Report.

At Te Whare Wānaka o Aoraki Lincoln University, New Zealand's only specialist university, we are focused on the land-based sectors and committed to advancing the United Nations Sustainability Development Goals (SDGs).

Through our teaching, research and leadership, Lincoln University is shaping a world that benefits from a greater understanding of the relationships between land, food and ecosystems. Our graduates and researchers are contributing to the land-based sectors, addressing both local and global challenges.

Lincoln University continues to experience strong growth in student headcount and significant advancements in refreshing our campus facilities. We have also seen a surge in postgraduate numbers, shifting the ratio of our student population towards this level of study. This reflects the University's influence in building a more sustainably productive future through impactful research and teaching.

This year, as part of our Campus Development Programme, the flagship science facility Waimarie opened. Built to Level 4 green star standard, Waimarie incorporates solar arrays, ground source heating and cooling, a rainwater-fed toilet flushing system and locally sourced woollen insulation. Our continued progress towards our sustainability goals saw the activation of 417 solar panels on Waimarie bringing the University's total annual solar generation up to 802,000kWh. Through various initiatives, including the Lincoln University Energy Farm, which is due to commence construction in 2024, we are committed to demonstrating first-hand sustainable land-based practices.

The University's Sustainability Plan outlines our commitment to a sustainable future and how we will continue to be leaders in education and research and achieve sustainability goals including being carbon neutral by 2030 and carbon zero by 2050.

This report highlights some of our sustainability efforts across the University during 2023, demonstrating our commitment across all areas including education, research, student experience, operations and engagement.

Ngā mihi

Professor Grant Edwards
Vice-Chancellor
Lincoln University

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SDG 1

End poverty in all its forms everywhere

Upskilling those in developing countries

The 2023 Completion Ceremony held at Lincoln University is both a celebration and farewell for those completing their qualifications through the Manaaki New Zealand Scholarship. The students, from Papua New Guinea, Fiji and Lao People's Democratic Republic, have been studying at Lincoln onscholarships administered by the New Zealand Ministry of Foreign Affairs and Trade as part of the New Zealand Aid Programme. The students, who are from developing nations, come to New Zealand to grow their skills and knowledge and take this back home to assist with social and economic development.

Lavenia Karavak of Fiji, who completed a Master of Environmental Policy and Management, plans to establish a sustainability consultancy agency in Fiji. Helen Moe David of Papua New Guinea wants to use her Master of Horticultural Science to increase food security at home while Phoukhaokham Xaymounty, who has a Master of Business (Finance), wants to help ease the financial challenges facing Laos.

Lincoln Alumni International Medal recipient helps combat poverty

Soane Patolo Jr was the honorary recipient of the 2023 Lincoln Alumni International Medal. He is the founder and Chief Executive Officer of the Mainstreaming of Rural Development Innovation (MORDI) Tonga Trust established to help empower isolated rural communities to fight against poverty.

After graduating from Lincoln University with a Bachelor of Resource Studies in 2003, Soane formed MORDI, an organisation that has made an important contribution to the well-being and prosperity of vulnerable communities in the Kingdom of Tonga. The organisation has facilitated increased agricultural input, bolstered agricultural productivity and transferred innovative and technological know-how to rural smallholder farmers who are the foundation of Tongan food and nutrition security. Now, with a team of 30 people, MORDI reaches 39,300 people in 7,300 households across 122 rural areas, supporting 80% of Tonga's rural communities.

Soane has been instrumental in improving healthy eating and food hygiene education amongst Tongan women, village-based sanitation, local water security and introducing new climate change adaptive farming systems. He has also built partnerships with universities in Australia, New Zealand, Japan and the European Union connecting academics with remote communities in Tonga, enabling research innovation to reach local Tongan industries.

How the digital age can support rural and agricultural development

Lincoln University's Professor Wanglin Ma has been investigating the role of information communication and technologies (ICTs) including the internet, phones, computers, tablets, platforms, networks, software applications and databases, in supporting rural and agricultural development in Asia.

In addition to publishing several articles on the subject, in 2023, Professor Ma edited a special issue on the theme, "Rural and Agricultural Development in the Digital Age" in the Review of Development Economics. With so much interest in the topic, a virtual international conference, hosted by the Asian Development Bank Institute was organised to facilitate interactive discussions among international scholars and experts in this field and select the best papers.

Drawing on studies of China, Vietnam and Pakistan, the special issue demonstrates that ICTs are important for increased productivity, income growth, poverty reduction, rural economic transformation, rural migration and employment, the empowerment of different demographic groups and financial inclusion. Policymakers need to look at making the internet more accessible to rural communities and ensure women have smartphone access, with a key finding that smartphone use empowers rural women in household decision-making and off-farm work participation.

SDG 2

End hunger, achieve food security and improved nutrition and promote sustainable agriculture

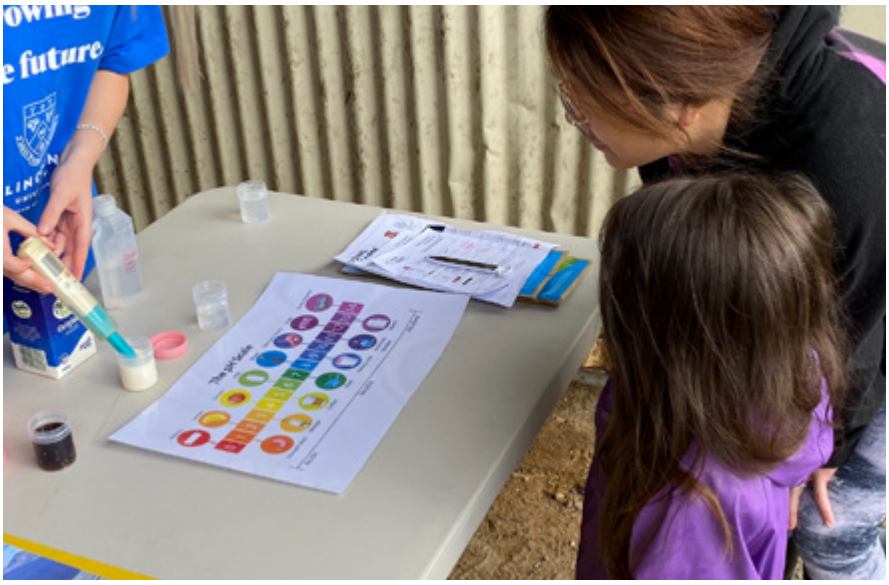
Rethinking New Zealand's supply chains to adapt to climate change

Professor of Agricultural Economics Alan Renwick at Lincoln University wrote in The Conversation that shortages in New Zealand's food supplies are a result of increasing challenges in supply chains from natural disasters and climate change.

Professor Renwick discussed how New Zealand's centralised food system has been optimised for economic efficiency rather than resilience. The outcome is a relatively small number of large-scale processing factories and the concentration of enterprises in specific regions. This means the supply chain relies on the uninterrupted movement of products across the country through the country's transport network that is being increasingly challenged by climate change through more frequent and intense weather events. These events and the projected sea-level rise are placing a strain on the already vulnerable food system. Professor Renwick shares how to potentially mitigate these challenges including utilising emerging technologies, discovering alternate uses for food waste and reducing the reliance on roads for transporting food around the country.

Food Transitions 2050 cohorts look at challenges in the food system

The latest cohort of PhD students to enrol in the Food Transitions 2050 postgraduate school commenced at Lincoln University in 2023, looking to help address challenges in the food system. The programme, delivered jointly by Lincoln and the University of Canterbury in partnership with Plant & Food Research, Manaaki Whenua Landcare Research and AgResearch, explores how to make food production and consumption more sustainable and to produce world-class research



that can contribute to policy-making both nationally and internationally. The students work on cross-disciplinary research projects encompassing economics, nutrition, agricultural science, and environmental policy.

Research partnership focuses on food security for Māori in Bay of Plenty

Lincoln University and the Whakatōhea Māori Trust Board have been granted funding from Te Pūnaha Hihiko: Vision Mātauranga Capability Fund to explore and develop a long-term spatial plan for multi-generational food sovereignty and security with the eastern Bay of Plenty Māori iwi.

Focused on strategic spatial planning for nutritional security, agroecological resilience planning and educational outreach, the project builds on the work Te Whakatōhea have been undertaking looking at the nutritional needs of iwi members and how to improve their well-being and health outcomes.

The partnership represents a profound opportunity to utilise and strategically implement the living memory of Te Whakatōhea kaumātua regarding historic food growing. Focusing on inter-generational teaching, alongside state-of-the-art Western science, the project addresses long-term planning for food security.

Offering sustainable, healthy food and free water on campus

Lincoln University continues to be committed to offering sustainable, healthy food options for students and staff on campus, including gluten-free, vegetarian, dairy-free, halal and vegan alternatives. Palm oil free products are used wherever possible and eggs and herbs are sourced locally. Water is freely accessible to all via drinking water taps and filtered hot and cold water in kitchen facilities. The on-site cafes are open to students, staff and the public along with a student dining hall and catering service.

While the University encourages reusable coffee cups, always practical at larger functions or events. On these occasions, compostable cups are used. These cups and all other packaging used at the cafes on campus are council-approved which means they are not sent to landfill. Sushi packaging

changed in 2023 to compostable trays, in paper bags, while portion-controlled units of soy sauce, wasabi and pickled ginger are no longer available to reduce plastic waste. The packaging for dishwasher chemicals was changed from hard plastic to cellulose-based plastic packaging. To be more energy efficient, iVario smart cooking centres were installed in the kitchens for boiling, frying, deep-frying and pressure cooking, replacing most traditional cooking appliances. It operates up to four times faster, using up to 40% less energy compared to conventional cooking appliances.

The Big Feed raises 700,000 meals

The Big Feed rural telethon was held on campus at Lincoln University. Farmer-led charity, Meat The Need, donates livestock and milk from farmers along with cash from the public to turn into meals and distribute to more than 110 food banks across New Zealand. The telethon aims to raise as many meals as possible to distribute to families and bring rural and urban communities together. In 2023, the target of 700,000 meals was achieved.

Global symposium brings leading scholars to Lincoln

Over a hundred researchers and agribusiness students worldwide attended the 2023 International Food and Agribusiness Management Association (IFAMA) World Conference symposium and Global Student Case Competition at Lincoln University. Leading scholars, students, policymakers and industry professionals attended the conference to discuss the strategic focus, transparency, sustainability and responsiveness of the food and agribusiness system.

The symposium featured researchers presenting their work about the global food system, with more than 150 peer-reviewed papers featuring interdisciplinary initiatives, international collaboration and indigenous innovation.

A team from Lincoln entered the Student Case Competition where each team worked through a case study on a real-world challenge to develop a practical solution and build a presentation sharing their analyses and recommendations to a panel of judges.

Bringing sustainable farming to the community

Owl Farm is a joint venture between St Peter's School Cambridge and Lincoln University. The working dairy farm demonstrates excellence in farm performance and sustainable practices. With the help of industry partners, the knowledge gained through the farm is shared with the wider agricultural industry as well as learning opportunities for students. In 2023, the Owl Farm Open Day allowed the wider community to come and meet calves, watch the cows being milked and view the many stands held by industry partners including Lincoln University, Fonterra Farm Source, PGG Wrightson Seeds, Ballance Agri-Nutrients and DairyNZ. Children who visited the Open Day were given a dairy expert passport containing questions, with answers found at each stand.

Exploring how forests can provide nutritious food in New Zealand

Lincoln University Centres of Excellence Transformative Agribusiness and Scion hosted a workshop exploring the idea of Food Forests in New Zealand. The workshop brought together researchers to discuss how designing and managing forests to provide quality nutrition for communities could boost food resilience. Participants came from a variety of institutions including Crown Research Institutes and Massey University. During the workshop, the group explored local food and forest systems, looking at the idea of food forests and understanding the logic, impacts and important research questions to ask. Workshop participants looked to collaborate across sectors to identify a coalition of stakeholders and researchers who want to form a part of a bid for a research programme on Food Forests.

SDG 3

Ensure healthy lives and promote well-being for all at all ages

Building resilience and mental health in young people

Funded by Massey Lincoln Agricultural Industry Trust (MLAIT), WellMates positive mental health and resilience programme was established for first-year students enrolled in agriculture courses at Lincoln University and Massey University.

In 2023, the research enabled the development of online modules of the WellMates programme for distance, diverse and online learners discussing mental health and resilience aimed at tertiary-aged young people from the rural sector.

Students from Lincoln and Massey University's Young Farmers Clubs present the online modules, growing their capabilities in wellbeing knowledge, presentation skills and leading group programmes. Research participant groups from both universities successfully worked through the modules online allowing for research data to be collected

Researchers reveal links connecting plant, animal and human health

Lincoln University researchers have identified a link between a modern and innovative grazing management approach for cattle and health benefits for humans. Funded by the Lincoln University Centre of Excellence – Designing Future Landscapes, Silver Fern Farms and Fertilizer New Zealand, the research is the first of its kind worldwide.

Professor Pablo Gregorini and Dr Anita Fleming demonstrated that beef cattle grazed under a functional diversity grazing regime, that is, allowed to choose from a selection of five strips of monoculture plant species, recorded up to 15% higher average daily weight gain and greater meat colour than cows grazing a conventional ryegrass-based pasture or those grazing a complex multispecies mixture.

Meat from the test animals was then consumed as cooked beef patties in human trials conducted at Lincoln, with the participants' blood tested at intervals of zero, three and five hours after each meal. Blood samples taken from participants who ate the beef from cattle eating the functional diversity grazing regime showed that their metabolisms were advantageously affected by an increased presence of Vitamin E - a potent antioxidant and anti-inflammatory, hydroxymethylglutaryl - known as statins and is used adjunctively with diet and exercise to treat hypercholesterolemia by lowering total cholesterol and arginine - used by the body to help build muscle and rebuild tissue.

Professor Gregorini added that the blood test results also revealed a reduced presence of indoxyl sulphate, a uremic toxin accumulating in the plasma of chronic kidney disease patients. Accumulation induces side effects in the kidneys, bones and cardiovascular system.

The research demonstrates the interrelationships between plant, animal and human health in a measurable way including the beneficial human health outcomes of eating higher-welfare food products. Trials were also conducted with dairy cows, sheep and deer using the same grazing systems and achieved similar results in the animals' performance, environmental impact and welfare.

Yoga heart health benefits explored

Lincoln University sports science scientists investigated if yoga can help adults of all fitness levels increase their physical activity and decrease their cardiovascular disease risk. In a cross-sectional study, 202 yoga and 181 non-yoga participants were compared to determine if arterial stiffness lowered in yoga participants to their benefit. Arterial stiffening, a diminished capacity of an artery to expand and contract in response to pressure changes, is a major cardiovascular disease risk factor. Their findings indicated that regular yoga exercise was associated with a 0.3 m.s–1 reduction in central vascular stiffness compared to non-yoga participants. This could be a useful non-pharmacological treatment for improving vascular health.

Alumni support the wellness of present and future students

Through the generosity of alumni donations, students utilising Lincoln University's gymnasium, Whare

Hākinakina, to play sports socially benefitted from new sporting equipment through the Sport and Healthy Living Initiative. During 2023, goalposts were purchased for indoor football. Badminton and volleyball continue to be popular, particularly with international students so new nets, rackets and shuttles were purchased. Student who attended the Selwyn Aquatic Centre were able to attend for free for a few months later in 2023. This was hugely successful and well-received by the students.

Sharing recreation facilities with the community

Lincoln University gymnasium, Whare Hākinakina, and its sports fields have been utilised throughout 2023 by community groups across various sporting codes and ages. These groups included high schools, Community Care Seniors, sports teams including cricket, rugby, squash and netball for club competitions and trainings. The Selwyn District Council held the Koru Games, a multi-sport tournament for Year 7 and 8 children from across Selwyn, Canterbury and the South Island with Lincoln University one of three hosting venues.

Winning partnership sees award for seniors programme

The partnership between Whare Hākinakina Lincoln University Gym and the Lincoln Community Care Association won the inaugural Community Partnership Award at the New Zealand Tertiary Recreation Awards presented at the annual University and Tertiary Sport New Zealand conference. The award recognised the 27-year partnership for providing exercise classes for adults aged 60+ years who live locally. The programme delivers three exercise classes per week to enhance physical health and foster social interaction for seniors. Whare Hākinakina staff regularly measure and assess the hand/eye coordination and balance capability of the seniors who participate in the classes.

New sponsorship supports local basketball talent

Lincoln University supports the health and well-being of Canterbury's young basketball talent by sponsoring the flagship high school competition. Basketball is the fastest-growing teenage sport for boys and girls in New Zealand. Partnering with Canterbury Basketball is an opportunity to promote sport and encourage teenagers to stay active while highlighting the opportunities available for them through Lincoln's land-based qualifications.

SDG 4

Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all

Course completion success at Lincoln University

Students at Lincoln University have the highest course completion rates in New Zealand compared to other universities, as identified by the Tertiary Education Commission (TEC) in the latest annual Educational Performance Indicators (EPIs).

Measuring the educational performance of all New Zealand tertiary education providers, the EPIs include course and qualification completion rates, retention rates and progression to higher levels of study.

Among universities in 2023, Lincoln University ranked first for course completion (90.5%), second for qualification completion (73.3%) and third for first-year retention rate (79.5%). Lincoln University is also the highest-ranked university for the three EPIs of qualification completion rates, course completion rates and first-year retention rates for Māori students. For Pasifika students, Lincoln is ranked first for qualification completion rates, first for first-year retention rates and second for course completion rates.

Evolving to meet the needs of students and the land-based sector

In 2023, Lincoln University introduced two new programmes, a Master of Parks Management and a Bachelor of Sustainable Tourism. The Master of Parks Management was developed in consultation with the New Zealand Parks Leaders Forum to address an urgent skills shortage. It is the first in the Southern Hemisphere and builds on the University's long history of teaching parks and recreation programmes.

Along with offering new programmes to meet the changing needs of the land-based sector, Lincoln offers flexible learning opportunities through Lincoln Connected online learning. The asynchronous online delivery mechanism allows 11% of total equivalent full-time students to study remotely with the number of courses increasing year-on-year. In 2022, 55 courses were available increasing to 59 in 2023.

Supporting Māori and Pasifika student experience and achievements

The Whanake Ake programme, within the larger Manaaki Tauira Programme, aims to increase participation rates for Māori and Pasifika students at Lincoln University. This is achieved through initiatives including growing the Māori academic workforce, revising programme content and engaging and collaborating with mana whenua and Māori partner organisations.

The programme addresses enrolment gaps impacting Māori by supporting academics to conduct assessments of their courses to identify areas for enhancements that lead to increased student success. In 2023, the University published bilingual marketing materials to promote programmes with high success rates for Māori and Pasifika students. Additionally, the Whanake Ake initiative facilitated the appointment of five strategic Māori emerging academics offering opportunities for postgraduates to progress in their early academic career.

Te Manutaki, the office of Māori and Pasifika Development, supports and monitors Māori and Pasifika student experience and achievements. In 2023, the office launched Ahu Pātiki, a leadership programme to deliver students a strong cultural grounding when arriving at Lincoln. The programme connects first-year Māori and Pasifika students with senior students and staff in a multi-day marae visit. This proactive and preventative programme ensures students are set up for success.

Removing financial barriers to Māori and Pasifika students

To continue to deliver inclusive education to all at Lincoln University, $3,727,501 in scholarships was offered in 2023, an increase of $53,025 from the previous year. Of this figure, numerous scholarships were available for Māori and Pasifika students totalling

$272,449. The Tihi Kahuraki and Pasifika Excellence undergraduate scholarships are two premier undergraduate scholarships offered, valued at $19,000 per year for the length of the degree to pay for both accommodation costs and tuition fees.

Children's University continues to grow

More than 1,100 Canterbury children, aged between seven and 14, graduated from Children's University. Forty-six Canterbury schools and two rūnanga took part, making it the biggest graduating cohort to date.

The initiative, from Lincoln University and University of Canterbury, saw students clock up 67,000 study hours in 2023. When children join, they receive a Passport to Learning which they complete by visiting libraries, museums, galleries, wildlife parks, taking part in campus experiences and completing online activities. Hundreds of children visited Lincoln for Campus Experience events, with activities including building a quake-proof structure, seeing a wind tunnel in action, 3D printing foodstuffs and experiencing an Antarctic temperature cold room.

Removing cost barriers to studying through fees free tuition

Lincoln University extended its popular fee waiver scheme to cover postgraduate, taught master's degrees and the taught component of research master's programmes for domestic students in 2023. As a specialised land-based university, Lincoln has strong connections with the food, fibre and environmental sectors, conducting valuable research for the industry and producing highly employable graduates in a range of sectors that urgently need more qualified people.

This initiative saw 1,626 students study across 46 qualifications tuition-free, covering subjects including agricultural systems, food innovation, conservation, environmental management, accounting, sport and recreation management, applied science, and commerce.

Dynamic scholarship programme showcases food and fibre industry

Future Leader Scholarship Programme participants attend Lincoln University completing a dynamic integrated leadership programme alongside their academic studies. As part of the Future Leader Scholarship programme, all third-year scholars must complete a project of their choice, working on its delivery with a team of first and second-year scholars.

In 2023, three Lincoln University students, Fergus Lee, Danielle Bain and Campbell Barclay, finished their three-year Lincoln project that saw high schoolers from across New Zealand gain a first-hand understanding of food and fibre careers through Agri-ventures. Though Agri-ventures has been introducing careers to year 11 and 12 students for the past five years, this was the first time it was available nationally, with 17 high school students attending a two-day camp. The students visited various organisations in the food and fibre sector from around Canterbury including a high-country station, dairy operation, PGG Wrightson, Farmers Mutual Group, PGG Wrightson Seeds Kimihia Arable Research Farm and FoodStuffs South Island warehouse to see the end products along the food supply chain.

'Grow' game plants a seed with students

Rabobank, Lincoln University and the Agribusiness in Schools Programme developed the Grow board game to support learning by Year 11 students studying National Certificate of Educational Achievement in Agribusiness and Agricultural & Horticultural Science. The game offers a fun way of learning the curriculum including biosecurity, soil composition, waterways, biodiversity, biological processes, animal behaviours and agricultural production by region. More than 550 sets of the Grow board game were sent to New Zealand secondary schools to support learning about food production at the secondary school level.

SDG 5

Achieve gender equality and empower all women and girls

Pathway helps women into the workforce

The latest Lincoln University Post Qualification Outcomes Survey found, of the 904 students who graduated in 2022, a higher portion of the students were female (456) compared to males (448). New Zealand permanent residents had the highest percentage of females with 60% compared to 40% for males.

The survey portion of this report includes responses from 492 graduates. By May 2023, 84% of graduates were in paid employment with the vast majority working full-time (86%). This shows that women are completing qualifications at Lincoln University and going on to full-time employment.

Research shows boardroom gender diversity lessens investment inefficiency

Research conducted by post-graduate student Sanaullah Farooq from Lincoln University, Professor Christoper Gan from Lincoln University and Dr Muhammad Nadeem from the University of Otago on gender diversity in the boardroom is one of the top 10 most cited papers published by Wiley in 2022/23.

The journal article, *Boardroom gender diversity and investment inefficiency: New evidence from the United Kingdom*, examines the link between boardroom gender diversity (BGD) and investment inefficiency (IE) based on a sample of United Kingdom (UK) businesses.

Following regulatory reforms in the UK to increase female representation on corporate boards, the study found that gender-diverse boards strengthen the financial monitoring of a business, improving decision-making and thereby reducing investing inefficiently.

Using a sample of UK-listed businesses from 2005 to 2018, the research found that female directors mitigate investment inefficiency through multiple channels. They actively participate in board activities, align senior management interests with shareholders through careful stewardship and promote information exchanges at management and board levels raising confidence in investment decisions.

The study also found corporate boards with three or more female directors have a significant and positive influence on investment decisions, leading to even greater improvements in policymaking.

The findings from this research deliver robust evidence that female directors improve the safeguarding of business assets and offer shareholders and corporate stakeholders greater confidence that their interests will be well-protected.

Promoting women into the wool industry

Kate Crawford, who is studying for a Bachelor of Agricultural Science, is the inaugural winner of the Ann Scanlan Scholarship. Established to support female Lincoln University students to pursue careers in the wool industry, the scholarship pays tribute to a highly regarded high-country farmer, Ann Scanlan. A role model to younger women, Ann developed one of the best merino flocks in New Zealand and won the Otago Merino Wools Association Clip of the Year title. She was also chairwoman of the Otago Merino Association, a long-standing committee member and a recipient of the Heather Perriam Memorial Trophy for services to the merino industry.

Striving towards land-based studies

Continuing a trend that began in 2018, Lincoln University's student population for 2023 has females outnumbering males. Of the total number of students 4,517, females totalled 2,580 while males were 1,929 and diverse 8.

Ensuring a safe, inclusive, respectful and welcoming environment

With a firm commitment to providing a safe, inclusive and equitable environment for all, Lincoln University has well-formed equity, diversity and inclusion policies, reaching those on campus and digitally, to support students and staff to achieve their full potential. The organisation has dedicated resources, policies and expertise addressing gender bias and unconscious bias to ensure equality for women across the student, academic and professional staff community.

Resources include the formation of the Equity, Diversity and Inclusion (EDI) Steering Group who recommend the effective development, establishment and implementation of EDI practices across the University.

Composed of student and staff representatives from the three faculties, the Professoriate, Te Tuawhiti, Te Manutaki, Student Experience, LUSA, Te Awhioraki,
SPACE and an international student member, the group report directly to the Vice-Chancellor.

Developing future career pathways for female university staff

The Lincoln University Career Development Programme for Professional Women Staff continued into its second year in 2023. This highly successful programme is partly funded by a grant from Graduate Women Canterbury to provide female staff with specialised support to help determine preferred career pathways and development. In 2023, 36 delegates attended eight workshops with overwhelmingly positive feedback received.

SDG 6

Ensure availability and sustainable management of water and sanitation for all

Improving water quality

Lincoln University Professor Richard McDowell is a world leader in the impacts of land use on water quality. Intensive land use, such as dairy farming, is a risk to freshwater quality with solutions needed to minimise the negative effects on water quality. In collaboration with DairyNZ scientists, Professor McDowell published an article examining the on-farm success of water quality management by analysing 20 years of data.

During the first 10-year period, farmers received support and advice through workshops, stream water quality and flow monitoring, farm practice surveys and identified solutions to address site-specific contaminant losses. The second 10-year period was post-extension, with only water quality monitoring and farm practice surveys continuing. Water quality improved across a range of contaminants such as phosphorus, nitrogen and E. coli, with 83% of water catchments showing improvement or no change in the first 10 years. Trend analysis across the 20 years showed concentrations were decreasing in 20 of 30 contaminant-catchment combinations, but concentrations were increasing for the other 10. Results showed that extension advice and on-farm practice change improve overall water quality over time but regulatory threshold values for some contaminant concentrations are not being met. More actions are required, over and above the Best Management Practices implemented.

New programmes in water management aim to meet the sector's changing needs

Lincoln University and the University of Canterbury signed a Memorandum of Understanding to continue a long-standing partnership in freshwater science and management with agreement to run postgraduate degree programmes as jointly awarded courses. Two new programmes commenced in 2023 to address the changing demands for graduates in the water sector including the Master of Science and Management.

With water being a significant issue both in New Zealand and globally, the partnership aims to provide postgraduate programmes specifically relating to freshwater, while aligning the shared strategic goals of both universities.

Fresh water for all around campus

On campus at Lincoln University water consumption is carefully measured and monitored. In 2023, usage totalled 194,839,000 litres. The campus' water network is tested approximately every five days at multiple points. This is directed by the University's water safety plan to ensure a constant source of clean, drinkable water across the facility. In total, around 300 tests are conducted each year.

Sharing research to encourage collaboration on water quality issues

The Lincoln University Centre for Environmental Research hosted the New Zealand China Water Research Centre Workshop, with guests from across New Zealand and China. Fifty-five guests attended including His Excellency, Xiaolong Wang Chinese Ambassador to New Zealand and Her Excellency Ying He, Consul General Chinse Consulate General making speeches at the beginning of day one. The two-day event was filled with presentations, where guests shared their research. Attendees were from Lincoln University, Crown Research Institutes such as SCION and Landcare Research and academics from Chinese universities including Huazhong Agricultural University and Beijing Academy of Agriculture and Forestry Science. Each discussed a relevant topic to water quality and contamination issues affecting farming. Day two of the workshop included a field trip around Canterbury visiting research sites.

SDG 7

Ensure access to affordable, reliable, sustainable andmodern energy for all

New Waimarie building boosts renewable energy sources

The 417 roof- and wall-mounted solar panels on the new Waimarie building on Lincoln University's campus bring the University's total annual solar generation up to 802,000 kWh, the equivalent to the annual electricity requirement of 110 average New Zealand households. For 2023, 43% of total energy consumed on campus originated from our solar arrays constituting renewable energy sources.

Campus heating upgrade delivers sustainable energy consumption

Progression of the Lincoln University heating upgrade continued in 2023 with over one kilometre of high voltage cable being replaced campus-wide to enable the electrification of campus heating, in preparation for decommissioning the central coal-fired boiler. During the year, the disestablishment of the Burns building saw a 15% reduction in campus coal use. To better manage energy consumption around campus, Lincoln University also committed to upgrading its building management system which allows for better control of the heating and lighting around campus, enabling future energy efficiency.

Evaluating China's pilot programme designed to reduce carbon emissions

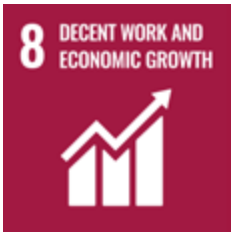
To understand how to grow an economy while being sustainable, Lincoln University's Puneet Vatsa and Professor Wanglin Ma, along with Huiting Niu and Jian Li, analysed the effectiveness of China's Low Carbon City Pilot (LCCP) programme aimed at reducing carbon emissions.

The study analysed data from 249 Chinese cities with results showing that the LCCP programme significantly improved energy efficiency and that future iterations could prove even more beneficial to China's efforts to tackle climate change. Cities with higher energy consumption experienced greater improvements in efficiency and technological innovation and upgrades to industrial structure positively affected programme results. The research demonstrated the value of subsidies and tax incentives to encourage research and development in green innovation. Adapting the programme to regional needs was important for positive results. Cities in resource-rich regions did not benefit as much from the programme so long-term investment is needed to achieve greater energy efficiency.

Improving the environmental impact of batteries

With a growing focus on sustainable energy, Lincoln Agritech Research Scientist Dr Joseph Nelson was awarded monies from the Marsden Fund to look for new materials to power batteries other than the standard lithium-ion. His research is looking for materials that are less expensive, less toxic, provide more energy for the same size and are easier to recycle than lithium-ion. Dr Nelson's project uses high-performance computing to predict the structure of new compounds and quantum mechanics to evaluate their energy potential. By the project's end, he hopes to have a comprehensive database of compounds viable for new batteries.

SDG 8



Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

Matching career aspirations with the needs of land-based employers

Employment outcomes are an indicator of Lincoln University's success in meeting both the career aspirations of students and the needs of employers in the land-based sectors. The University's success in achieving high employment outcomes is reflected in Lincoln University's graduate employment rate of 84% published in it's Graduate Outcomes Survey Report. Of the 84% in paid employment, 86% were working full time and of those who were not in paid employment, 56% had enrolled to study further. Of employed respondents, 36% were working in the agriculture, forestry and the fishing industry. Lincoln University relies relies on industry evidence to support its view of how effective and sought-after its graduates are in New Zealand and overseas. This is supported by the Tertiary Education Commission's Post-Study Outcomes data available through Ngā Kete which shows Lincoln has the highest percentage of students under 25 years of age in employment of all New Zealand universities.

Producing work-ready graduates

Building connections with industry both nationally and internationally sees Lincoln University build important partnerships with one being with the world's largest logistics company, Kuehne + Nagel (K+N). The partnership helps match graduates with work opportunities. Lincoln University Supply Chain Management students, Sasha Van Beek and Max Dobbe were chosen to complete internships at K+N in New York through a programme established by the company and the University. Representatives from the company overseeing the intern programme visited Lincoln University to reconfirm the programme after COVID placed it on hiatus.

Associate Professor Mark Wilson, who heads the Supply Chain Management programme from which graduates can apply for the internships, says a Bachelor of Commerce degree, majoring in Supply Chain Management, is a relatively unique programme in New Zealand, as it focuses on industry contexts and its mixed delivery of learning produces work-ready graduates.

Growing leaders and developing core skills

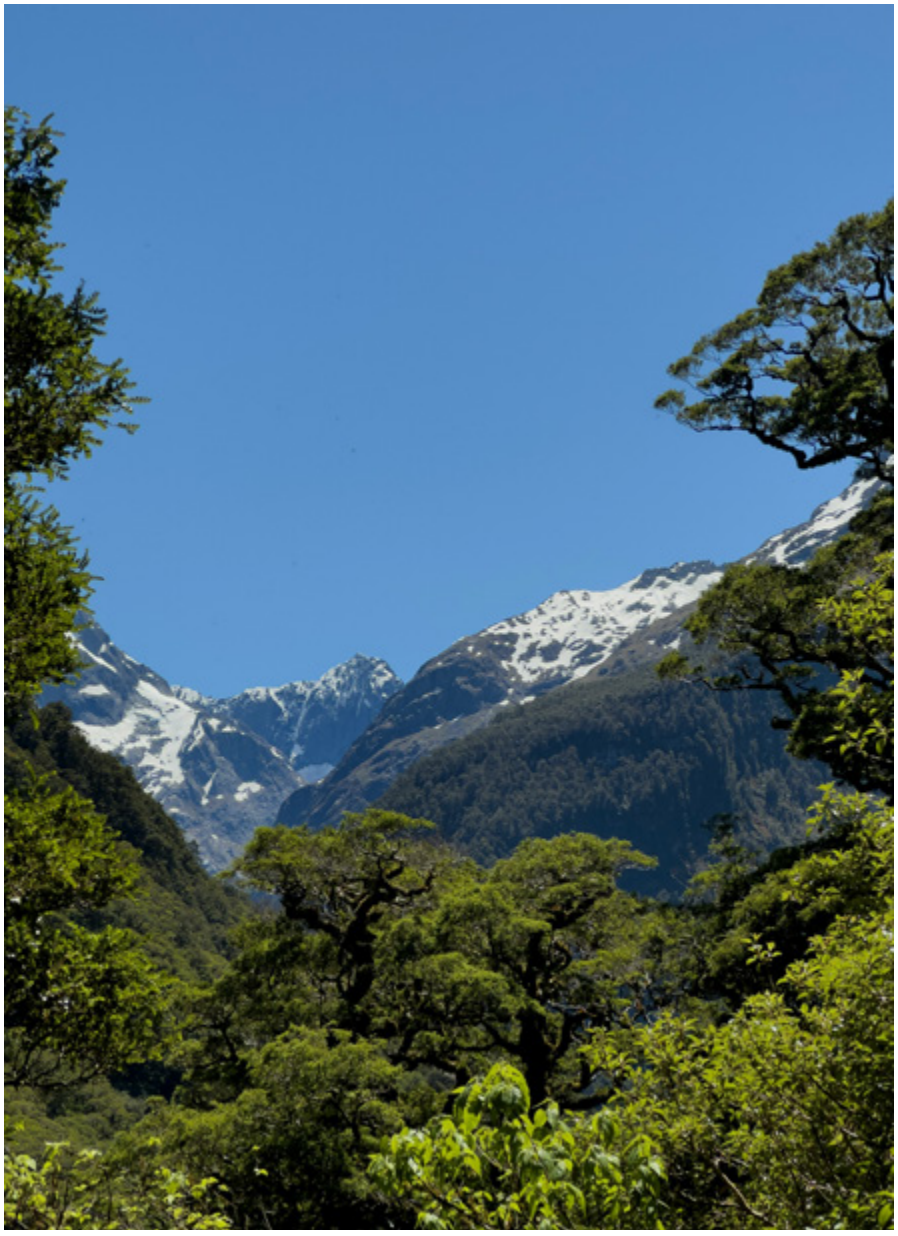
With the continued demand for courses through Lincoln University's Staff Learning and Development Programme, the breadth of opportunities grew in 2023. A total of 919 staff attended courses with 11 new courses on offer. These included health and safety, mindfulness, building a respectful workplace, Te Reo Māori, mental health support and sustainability in the workplace.

The highly successful Lincoln University Leadership Development Programme continued into its second year. Ninety-five managers across academic and professional staff took the opportunity to hone their leadership skills, deepening their knowledge of how to develop their style, manage challenging situations and understand the core requirements of leaders at the University.

The programme encompasses three workshops covering management and leadership topics, completing a personality questionnaire, three one-on-one coaching sessions and self-reflective exercises to develop an individual's understanding of leadership.

SDG 9

Build resilient infrastructure, promote inclusive and sustainable industrialisation and foster innovation



Bringing focus to tourism's impact on the environment

Kim Hill Hot Topic is an annual event held at and sponsored by Lincoln University featuring a panel of experts who discuss a pressing environmental issue to encourage conversations around sustainability. In 2023, tourism's impact on the environment was examined with Kim Hill and Lincoln University Associate Professor Stephen Espiner who specialises in natural resource management and environmental change in parks, recreation and tourism, Principal Science Investment Advisor Susanne Becken from the Department of Conservation, Christchurch City Councillor Tyla Harrison-Hunt and Christchurch Airport Chief Executive Justin Watson.

New app for apple industry

Lincoln's research and development subsidiary, Lincoln Agritech, has developed an app to improve orchard fruit thinning. For a successful harvest, orchardists need to count how much fruit has set, and how much needs to be thinned to ensure maximum quality. Then they count again to check the thinning has been completed properly, a time-consuming and tedious task.

As part of a project funded by the Ministry for Primary Industries (MPI) and New Zealand Apples and Pears Inc (NZAPI), Lincoln Agritech's Precision Agriculture team processed thousands of images of flowers, fruitlets and fruit counts on trees. Using a specialised artificial neural network they extracted and interpreted features from the canopy images with this information used in the app. Growers take photos of trees that have been thinned and use the app to assess whether thinning targets have been achieved. Trials with growers showed the app achieved an accuracy rate of 85 to 90%, an acceptable range for industry. The app reduces the skill set and time to complete a job crucial to a successful harvest.

Innovations in dairy farming

With a growing awareness of the connection between the health of the land, animals and humans, visions of new ways of farming are taking shape with the Lincoln University Centre of Excellence Designing Future Productive Landscapes Integral Health Dairy Farm. On-farm, researchers test and demonstrate how new and transformational systems can be productive.

A field day was held to share production results and advances in what has been implemented to date and the next steps. The Integral Health Dairy Farm creates niche spaces for researchers to test novel ideas and develop technical and social innovations that can evolve

into multiple dimensions, creating configurations that work. These practices influence user and consumer preferences and product development.

Connecting students with employers in the food and fibre sector

The annual Food and Fibre Awards and networking dinner recognises some of Lincoln University's highest academic achievers while offering students the opportunity to build connections with prospective employers. The event was held on campus and featured an awards ceremony where Associate Minister for Agriculture and Education, Jo Luxton, honoured the top students in selected programmes.

A networking session allowed industry professionals to liaise with future employees (students) with twenty-five sector organisations present at the event including Fonterra, AgResearch, Ravensdown, Beef + Lamb New Zealand and PGG Wrightson. This opens students up to opportunities for summer work, internships and beyond.

Aside from showcasing academic prowess and providing networking opportunities, the evening featured a stimulating panel discussion with three successful Lincoln alumni who shared their views on the intricacies of the food and fibre sector.

Addition of Fonterra paves way for greater insights into sustainable dairy farming

Fonterra joined the South Island Dairying Demonstration Centre (SIDDC), a partnership between Lincoln University, DairyNZ, Ravensdown, LIC, AgResearch, and dairy farmers based on the Lincoln University Dairy Farm. The partnership was established to demonstrate expertise and emerging sustainable dairy production practices. The addition of Fonterra, a global dairy co-operative, to SIDDC brings an understanding of the needs, expectations and demands of milk and dairy consumers and will continue to allow the partnership to offer farmers practical tools to implement on their own farms.

Showcasing career opportunities in agriculture

Twenty high school students from across the South Island visited Lincoln University for a four-day educational camp demonstrating career pathways in the food production supply chain. The Rabobank FoodX Programme visited a range of agribusiness operations across the Canterbury region including sheep and beef, cropping and dairy farms, Food and Arable Research (FAR), Fonterra, Lincoln New World, Oakley's Premium Fresh Vegetables and the New Zealand Merino company. The camp aimed to show participants potential career paths connected to the sector in areas like marketing, research and development and logistics.

SDG 10

Reduce inequality within and among countries

Advocating for a culture of equality and diversity in agribusiness

Arabella Dudfield is one of 25 young women and non-binary people chosen as this year's YWCA Y25 cohort. The Lincoln University student was recognised for her work as the Lincoln University Student Association's Rainbow Equity, Diversity, Inclusion and Well-being representative. The Bachelor of Agribusiness and Food Marketing student is also Co-President of SPACE, the University's student-led LGBTQIA+ organisation focused on fostering inclusivity and support for rainbow students including helping hold the University's first queer ball in 2022. She also played a central role in organising Pride Walk on campus during World Pride Month.

Empowering ethnic women to take the lead for positive change

The Ethnic Women Leadership platform, founded by Lincoln University's Dr Hafsa Ahmed, pioneered this course – a first of its kind in New Zealand. Designed and led by ethnic women for ethnic women, the course aims to build confidence, resilience and connections by empowering participants to become catalysts for positive change. The course encourages and supports ethnic women from across the country to share their stories, experiences and achievements.

In 2023, Paola Serola participated in the course. Despite facing numerous obstacles as a newcomer to New Zealand, Paola's resilience and leadership skills shone through in the seven years she has resided in the country. Paola is actively involved in the local community, contributing to organisations like Christchurch Resettlement Services and the Dante Alighieri Society of Christchurch. Her involvement has enabled her to connect with fellow migrants, offering them support. Paola credits the Ethnic Women's Leadership course with having a profound effect on her - giving her greater confidence and tools which she intends to share with other migrants.

Diversity grows on campus

With the opening of New Zealand borders after COVID-19, Lincoln University welcomed more international students up from 18% of enrolled

students in 2022 to 21% in 2023. The university celebrated the many cultural backgrounds of its students with the World Day for Cultural Diversity, an event held to facilitate growth and build partnerships with all students. Artwork and reflections on what diversity means were shared at the annual Selwyn Culture-Fest, a local event part sponsored by Lincoln University. The festival celebrates 30 cultures through sharing food, music, traditions and recreation.

Taking the pride pledge to support the rainbow community

With a commitment to all LGBTTQIA+ (rainbow) people having the freedom to be safe, included, healthy and visible, Lincoln University took the Pride Pledge. This encourages everyone to actively support and celebrate rainbow communities and promote inclusion, diversity and belonging on campus. The Pride Pledge organisation supports companies and institutions on their rainbow journey with information and training for staff and students to grow awareness and understanding of rainbow issues. A part of this commitment was holding Pride Walk on campus which involved acknowledging and celebrating the two rainbow crossings at the University. Organised by Lincoln's LGBTQIA+ student group, SPACE, the colourful event began with a walk from Calder Drive rainbow crossing and concluded near Forbes Lawn at the first rainbow crossing installed at the university.

SDG 11

Make cities and human settlements inclusive, safe, resilient and sustainable

New building fit for future environmental credentials

Waimarie, Lincoln University's science facility, opened in 2023 and is now home to the Department of Pest Management and Conservation, the Department of Soil and Physical Sciences, Faculty of Agriculture and Life Sciences professional staff, Bioprotection Aotearoa and other research partnerships. Built to level 4 green star standard, Waimarie has a minimal environmental impact, featuring roof- and wall-mounted solar arrays, a ground-sourced heating and cooling system, a rainwater-fed toilet flushing system and uses recycled materials where possible in its construction.

The new facility is insulated with 10 tonnes of locally-grown wool from 2,000 sheep and the supplier of the 100% New Zealand wool carpet is owned by over 700 Kiwi wool-growing farming families.

The 417 roof- and wall-mounted solar panels bring the University's total annual solar generation up to 802,000 kWh, the equivalent to the annual electricity requirement of 110 average New Zealand households.

Recycled materials used in Waimarie's construction include pulverised fuel ash in the concrete pours while oak beams are installed in the ground floor teaching spaces, milled from oak trees from the campus.

The Canterbury clay brick façade was extracted and made within the Selwyn district.

A seismic dampening solution from Tectonus, featuring rocking shear walls, decreased the steel weight of the building and reduced the foundation depth while increasing the building's earthquake resilience.

Reducing carbon emissions through campus and community initiatives

Lincoln University's Sustainability Fund supports sustainable research and teaching practices on campus along with community initiatives aimed at reducing emissions. The fund receives and allocates monies from the 5% sustainability surcharge applied to University air travel bookings.

The fund's goal is to encourage staff and students to develop their academic endeavours while reducing emissions and to support initiatives that reduce Lincoln University's carbon footprint, showing progress towards reaching the carbon emission reduction target of 50% by 2030.

Sustainability Week brings heightened awareness

A fun-filled week of activities encouraging sustainable living was held on campus, part-funded by Lincoln University. Hosted by Sustainability Action Group for the Environment (SAGE), Lincoln University Student Association (LUSA) and Lincoln Environmental Sustainability Society (LESS), activities included free pancakes for those who travel sustainably by bike, e-bike, bus or carpooling. A waste-busting activity highlighted recycling opportunities on campus while a panel discussed Lincoln University's journey from coal to renewable energy through hydroelectricity, solar electricity generated from panels on campus and a ground-sourced heating system. During the week a presentation outlined the university's plans to reduce emissions. The week concluded with a weeding activity at the arboretum, followed by a talk by ecologist, Colin Meurk.

Encouraging sustainable practices on campus

Lincoln University's Sustainability Action Group for the Environment (SAGE) comprises of staff and students who actively promote sustainability around campus and support the university's goal of being carbon-neutral by 2030.

Every year, SAGE helps organise Sustainability Week hosting events with Lincoln University Student Association (LUSA) and Lincoln Environmental Sustainability Society (LESS). Activities support and promote awareness and adoption of sustainable practices in areas including native biodiversity, sustainable transport, renewable energy, sustainable design and waste management.

During 2023, SAGE activities on campus included seminars for students and staff on, for example, e-bikes and climate anxiety and free monthly bike checks to encourage students to use sustainable transport options. The team also made a submission to the Climate Change Commission on its five-year plan.

Strengthening connections within the disability community

Lincoln University Bachelor of Commerce student and Future Leader Scholar Sophie Williams worked with the charity Selwyn Launch Group and the Selwyn District Council to organise the Connect and Accept event. This hugely successful event connected families of people with disabilities with services available to strengthen and forge community relationships. More than 25 stalls represented organisations such as Arts Integrated, the Canterbury Down Syndrome Association and the Halberg Foundation. Guest speakers engaged with attendees about disabilities, futures, education, opportunities and challenges.
The event included a fun component too, viewing vehicles and machinery, a mobile animal farm, outdoor activities and games, a sensory room and a tearoom.

Low-impact farming buffer solution to peri-urban zone issues

A low-impact farming buffer could lessen tensions over encroaching urban development says Lincoln University researcher Dr Shannon Davis. As part of the 'Our Land and Water National Science Challenge', Dr Davis researched attitudes towards the peri-urban zone, or the interface between urban and rural land, and how to cater for housing while retaining highly productive soils.

According to her research, incorporating a buffer zone between intensive farming activity and urban residents could help relieve issues and maintain food production.

Low-impact farming involves small-scale, diverse operations and low artificial input farming creating distance between residents and conventional, larger-scale export-orientated production.

The first stage of the research involved surveying residents who lived in the peri-urban zone, and the farmers and growers they lived alongside. The survey showed urban residents felt positive about living near food-growing areas and valued those working the land. Growers and farmers in contrast were not as positive about their urban neighbours as they faced difficulties working close to where people resided. It also uncovered a desire from both groups for greater communication and connections.

SDG 12

Ensure sustainable consumption and production patterns

Sheep farmers need help to become sustainable

New Zealand sheep farmers might be keen to adopt sustainable practices, but Lincoln University researchers have shown many need assistance to implement changes. Based on data collected from a survey of New Zealand sheep farmers, the critical analysis published in 2023 found an attitude–behaviour gap. Although there were positive attitudes towards sustainability transition, this did not necessarily lead to a higher likelihood of adopting new tools.

Sheep production is regarded as more environmentally friendly than dairy and beef cattle, with less direct damage to the environment and lower water requirements. However, New Zealand cannot achieve a transition to sustainable agricultural production without sheep farmers adopting changes. Research shows policymakers need to help farmers overcome barriers to achieving sustainable production by finding ways to turn intentions into adoption. Policymakers could offer training, farm extension programmes and visit on-farm to educate farmers and thereby reducing the uncertainties of sustainable production.

Iconic farm manuals are a must-have on-farm

Since the 1960s, the Farm Technical and Financial Manuals produced by Lincoln University have assisted tertiary students, farmers and agribusiness consultants in making informed decisions as part of their planning processes.

The first published book was the Farm Budget Manual 1968-69. As the demand for greater information increased, the book was split into the Financial Budget Manual and Farm Technical Manual. They are a source of unbiased knowledge of New Zealand agriculture and include environmental planning and analysis tools, carbon pricing, land use decisions, succession planning and agricultural markets and pricing.

To assist with farm accounting, the Financial Budget Manual details budgeting and costs, various enterprise profitability and taxation. Detailed costs include animal health, apicultural products, crop and seed costings, vegetable levies and weed control.

Compiled with the general practitioner in mind, The Farm Technical Manual provides comprehensive data from many sources including information on livestock management, pastures, crops, forage crops, soils, fertiliser and irrigation.

Would you drink wastewater?

Dr Luca Serventi, a food innovator specialising in upcycling food wastewater into new products, edited Sustainable Food Innovation in 2023, part of the Springer Nature Sustainable Development Goals Series. He also contributed a co-authored chapter based on his research at Lincoln University often conducted with Bachelor, Masters and PhD students entitled Understanding New Foods: Water Quality. With water scarcity and pollution risks rising, water reuse is important for water conversation plans. From producing whey and tofu, food wastewater can be used to manufacture new beverages. The study assessed how consumers in China perceive local water quality and the safety of reclaimed water, finding both are a concern. Reducing consumers' risk perception of food wastewater is critical to the uptake of new, sustainable beverages.

Solving real-world problems through practical solutions for farmers

Taking an immersive and interdisciplinary approach to education and research, Lincoln University's Living Laboratory (LL) features an arboretum, home to exotic and native flora and fauna, including the largest collection of magnolias in the South Island. The LL also features two dairy farmlets.

The LL allows students to develop their real-world problem-solving skills with Lincoln University seen as a collaborative hub where students, academia, iwi and industry participants come together to address challenges facing the land-based sector.

The farmlets, each 12 hectares, are designed to explore the most suitable

dairy farming practices to meet the environmental, social and economic challenges facing farmers now and into the future. Research looks at how to promote biodiversity and resilience in soils, plants, animals and people while reducing inputs, improving recycling of nutrients and reducing waste, all while maintaining or improving profitability. Both properties have adopted either a conventional farming approach or a future design approach to achieve these outcomes. Decisions are science-based, or where the science is limited, new approaches are tested and measured. Students, researchers and public and private enterprises test and monitor ideas and solutions to help solve real-world problems. The practical work conducted on the farms makes it an ideal learning environment, with several Lincoln University agricultural courses featuring an LL component.

Monitoring food waste on campus

Continuing to encourage sustainable and environmentally conscious behaviours, Lincoln University measured and monitored food waste on campus in collaboration with Waste Management Company. All unsold food from the student canteen and cafes on campus was weighed and collected in 2023, allowing for accurate measuring and reporting of 25.53 tonnes of waste.

Disposing of university assets sustainably

A framework for disposing of assets at Lincoln University was initiated in 2023. The framework seeks those responsible for assets to consider, before sending the item to landfill, if the item can be used as a critical spare part, offered to another faculty within the University, sold externally, traded in when purchasing a new asset or recycled.

Research uncovers marketing strategies for plant-based milk alternatives

Lincoln University's research into United States consumers' preferences for plant-based milk alternatives published in Beverages, offers marketers valuable insights for crafting effective messaging, carefully considering how to communicate the benefits of plant-based milk alternatives. Conducted by Lincoln University's Dr Meike Rombach, Dr Lei Cong and Associate Professor David Dean, the study discussed how both plant-based alternatives and dairy beverages could be enjoyed by consumers. With global resources become more limited, dairy production may not meet consumer demand in the future. Plant-based milk alternatives could be promoted as supplementary beverages, complementing dairy milk's protein volume, while offering their own nutritional benefits such as lower fat content. This position would appeal to plant-based milk alternative enthusiasts while helping lessen negative sentiments among dairy milk consumers.

SDG 13

Take urgent action to combat climate change and its impacts

Investigating grape ripening and temperature rises in the face of climate change

A study by Lincoln University as part of a Ministry of Business, Innovation and Employment funded programme led by Bragato Research Institute shows elevated temperatures can influence Pinot Noir grape quality during ripening which has major implications in the face of climate change.

The work conducted by Lincoln's Dr Romy Moukarzel, Dr Amber Parker, Dr Olaf Schelezki and Professor Brian Jordan offers insights into climate change impacts for future Pinot Noir production. The research investigated how temperature changes in controlled environments impacted Pinot Noir grape yield and quality. This was the first study to give a detailed analysis of individual amino acids and phenolics in Pinot Noir in response to temperature changes during ripening.

Unlocking the potential of microbial bioactive compounds

Recipient of a Ministry of Business, Innovation and Employment 2023 Endeavour Fund grant, Dr Artemio Mendoza-Mendoza's research examines how unlocking the potential of microbial bioactive compounds can promote forest health. The project received nearly $1 million in funding to develop an alternative to agrichemicals to encourage tree health and mitigate climate change. To maintain New Zealand's $6.25 million forest industry, 54 tonnes of copper fungicides are used annually to fight pine pathogens. In addition to creating a significant economic cost of $57 million yearly, the fungicides present potential environmental, human health and social costs. The new product is anticipated to have a high export potential with significant financial benefits to New Zealand.

Advising government on actions to support cyclone recovery effort

Associate Professor of Planning and Environmental Management at Lincoln University, Hamish Rennie, is one of the 11 members of the Severe Weather Events Recovery Review Panel. The panel was established through the Severe Weather Emergency Recovery Legislation Act 2023 (SWERLA) to advise the Minister of Cyclone Recovery and other government Ministers on actions in response to Cyclone Gabrielle which damaged parts of New Zealand's North Island.

SWERLA facilitates the recovery from natural disasters by enabling existing legislation to be relaxed or operate more flexibly through Orders-In-Council (OIC). An OIC can override, amend or temporarily replace legislation.

As required by SWERLA, the panel includes expertise in public and administrative law, Māori land tenure, local Māori mātauranga and tikanga perspectives, environmental and health protection, primary industries, biodiversity, climate change, emergency management and local Māori and community interests. The panel considers each OIC and responds with its recommendation to the relevant Ministers.

Mucking in and helping in the wake of Cyclone Gabrielle

The Handy Landys, Lincoln University student volunteers, were awarded the Supreme Award winner at the 2023 Blues and Golds for their work in rural communities, fundraising to travel to Hawke's Bay in the wake of Cyclone Gabrielle to help farmers. Sponsored by the University, club members have become natural disaster specialists, lending a hand after earthquakes and floods, with these events becoming more frequent with climate change. The Handy Landys raise funds through, for example, apple picking or repairing fences and clearing land so when there is a call for help, they can jump into action.

Giving guidance and timely advice on post-flood plant health

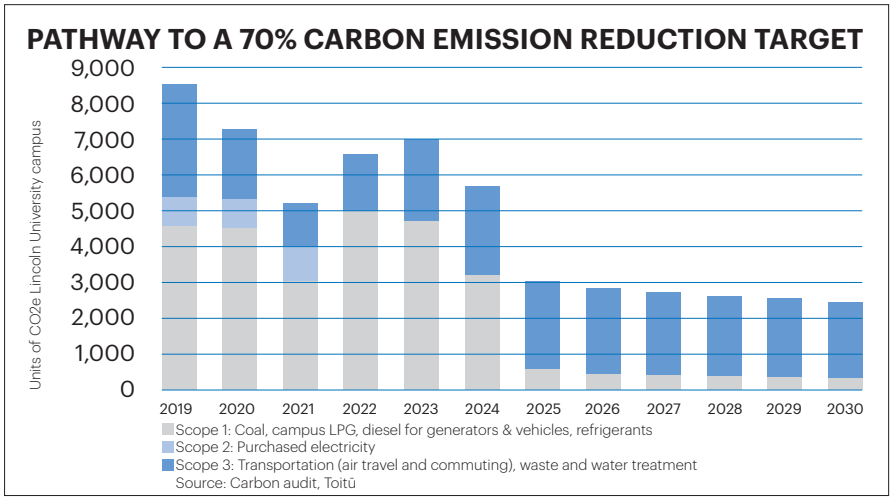
New Zealand Plant Producers Incorporated published Lincoln University guidance on managing nursery stock following the extensive flooding in the North Island. The extension note by Lincoln

University was designed to help affected producers with short-term recovery efforts focusing on plant recovery, outlining actions in areas: water removal, silt (sedimentation) management, plant nutrition and plant protection.

Reducing carbon emissions on campus

Reducing carbon emissions and contributing to a sustainable future continue to be a focus of Lincoln University. Toitū Envirocare carbon reduce certification was achieved in 2019, 2021, 2022 and 2023. The framework allows the University to benchmark and measure carbon emissions, seeing where progress has been made and what areas need improvement.

Other sustainability initiatives by Lincoln include increasing the proportion of EVs in the fleet. Currently, EVs account for 27% of vehicles with the goal to rise to 100% and be carbon zero by 2030. By 2025, coal will be phased out as power generation followed by diesel generators by 2030. All new buildings will adhere to Green Star building standards while 2023 air travel emissions of 1,017 tCo2e were offset at the University. Lincoln is also instigating ways to reduce carbon emissions for field trips. Students are encouraged to cycle or carpool to campus. The on-campus food services teams compost food waste while looking to reduce this volume. Initiatives extend to teaching, with course content focusing more on improving the sustainability of the primary sector.



Agricultural landscape design offers chance to mitigate wildfire risk

Lincoln University researchers Associate Professor Tim Curran, Postdoctoral Research Fellow Md Azharul Alam, Resource Management Planner Tanmayi Pagadala and Senior Lecturer in Grazing Lands Ecology Thomas Maxwell wrote an article for The Conversation discussing how different crops and pastures can be used to reduce the risk of wildfires. In the article on fire-smart farming, the team shared their research into commonly grown New Zealand crops and pasture, measuring the flammability of shoots and whole plants up to 70 cm long. The plants included fruit, forage and cereal crops along with pasture grasses and legumes. They found 51% of the plants did not ignite while in contrast, some fruit and cereal crops were highly flammable. By identifying plants with low flammability, these can be grown strategically on agricultural land to suppress wildfires.

SDG 14

Conserve and sustainably use the oceans, sea and marine resources for sustainable development

Looking at ways to productively use newly claimed seascapes

Master of Applied Science in Environmental Management student Faye White wrote her thesis on *'Newly claimed seascapes: Options and potential applications.'* As the world is challenged by rising seas, much of the current response is focused on protecting human populations, investment and infrastructure. As communities are forced to move from coastal areas, the submerged land mass has been termed by Faye as newly claimed seascapes (NCSs). Her research looks at how these areas can be repurposed for aquaculture, fisheries, wetlands, and/or blue carbon.

Using New Zealand as a case study to explore the feasibility of repurposing the NCSs under current legislative frameworks, Faye found doing so may have a fundamental role in determining the future health of coastal environments and the well-being of coastal communities. Thirty-nine ways of repurposing NCSs were identified in the research with considerations for their benefits and drawbacks in helping coastal communities. In 2023, Faye published her findings and presented this work at the MARE Maritime Research conference.

Reforming policy to protect the health and resilience of marine life

As the ecological health of the ocean deteriorates from human mismanagement and pressures on coastal environments from climate change, governments need to support the well-being of ocean ecosystems. This is a complex situation with conflicting uses of marine spaces and interests in its management. To highlight ways New Zealand marine reforms can better reflect ecosystem thinking, where the ocean is viewed as a living, related system to which people have reciprocal relationships, Lincoln University Associate Professor Hamish Rennie along with Elizabeth Macpherson, Eric Jorgensen, Adrienne Paul, Karen Fisher and Julia Talbot-Jones, wrote the article *'Designing Law and Policy for the Health and Resilience of Marine and Coastal Ecosystems—Lessons From (and for) Aotearoa New Zealand.'*

The authors discuss how law and policy across fisheries allocation and management, biodiversity conservation, managing environmental effects and Māori/Tiriti rights can be aligned with the function of marine ecosystems. They suggest New Zealand needs an overarching strategy that sets out the vision for the health of ocean ecosystems in partnership with Māori and applies this across sectors as they affect marine areas. The findings in the article are relevant for transnational marine law and policy in other countries offering a guide to reforming marine laws to represent marine ecosystems, protecting their health and resilience.

Decommissioning ocean-based oil and gas structures

Thousands of offshore oil and gas structures including platforms, pipelines and other subsea infrastructure, are reaching the end of their operational life. Under international maritime law, infrastructure on the continental shelf or in Exclusive Economic Zones must be removed at the end of life. However, this does not apply to subsea pipelines and other structures or infrastructure located in territorial waters.

While removal ensures safer navigation and prevents marine pollution, there are some cases when it can be valid to leave infrastructure in place. There are significant environmental, societal, technical and economic impacts associated with decommissioning, alongside policy and technical considerations. Removal of these structures may not always be the best case for the environment and decisions cannot be based on economics alone. With much infrastructure to be decommissioned and involving a complex process, an interdisciplinary cohort of 35 global experts came together to identify a decision-making process for decommissioning and to understand their potential impacts. Lincoln University Provost, Professor Chad Hewitt, was part of the study that identified 10 priority areas for consideration. The study outlines a roadmap for decommissioning research to better inform decision-making around a critical issue for our oceans.

SDG 15

Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification and halt and reverse land degradation and halt biodiversity loss

Kazakhstan conservation work earns international award

Albert Salemgareyev has become the second consecutive Master of International Nature Conservation student to win a prestigious Whitley Award. This joint degree gives a unique global perspective on conservation with students learning at two leading universities - Lincoln University and the University of Göttingen in Germany. The award is presented by the Whitley Fund for Nature (WFN) to individuals who combine the latest science with community-based action to benefit biodiversity, climate and people.

Albert's ongoing work with the critically endangered saiga antelope in his native Kazakhstan was recognised with his project addressing the emerging conflict between saiga and pastoralists over water and grazing sites. His work is looking for sustainable solutions and a community approach involving all stakeholders so the success of the saiga returning to record high numbers from conservation efforts is not threatened.

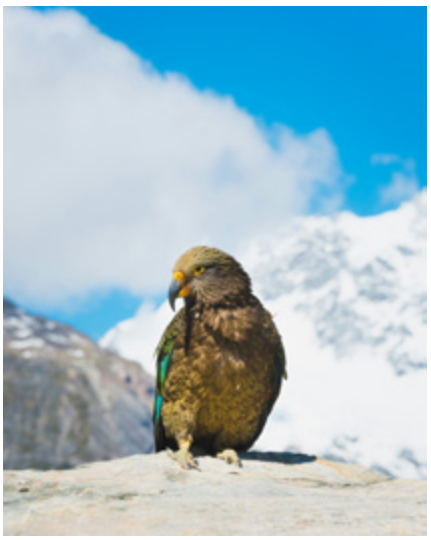
Albert is the Lead Specialist at the Association for the Conservation of Biodiversity of Kazakhstan (ACBK). His research has created more than four million hectares of protected land across Kazakhstan.

Ecological professor honoured for ground-breaking research

Lincoln University Distinguished Professor of Plant Biosecurity, Philip Hulme, has received a prestigious honour recognising his innovative work in ecology. The Te Tohu Taiao Award for Ecological Excellence was presented to him by the New Zealand Ecological Society.

The award is given to an individual who has made an outstanding contribution to the study of ecology in New Zealand and impacted the conservation and management of the country's unique natural environment.

Over the past two decades, Professor Hulme's ground-breaking research on plant invasions has reinvigorated the discipline and made an impact nationally and internationally. This has led to him being ranked among the top 0.1% of scientists worldwide yearly for the past nine years. Speaking at the awards, Professor Hulme highlighted the risks facing New Zealand due to the reduction of resources to manage weeds on the country's conservation estate. His recent research has examined the spatiotemporal population dynamics of wilding conifers in New Zealand, eco-evolutionary shifts in weeds following their introduction into new regions, and the susceptibility of New Zealand ecosystems to plant invasions.



Kea calling plantation forests home need protecting too

Lincoln University PhD student Jodanne Aitken is co-author of a preliminary study on efforts to protect the threatened kea. She spent a year tracking kea movement in a Nelson plantation forest adjacent to a conservation area. The research is the first of its type with kea in this type of habitat. This is important research with plantation forests occupying 1.73 million hectares of New Zealand's total land area, and with fewer than 7,000 in the wild, kea is threatened and nationally endangered, the second-highest threat level in New Zealand.

Jodanne found the native birds fed, roosted and nested among the pine

trees and may benefit from predator control undertaken in these areas. Therefore, monitoring and controlling predator species with kea-safe devices would be advantageous. Understanding kea ecology, behaviour, abundance, distribution and habitat use in these areas is vital for conservation practitioners and forestry companies to make informed wildlife management decisions alongside running viable commercial forestry operations.

Solving kākāpō mystery

Lincoln University researchers have contributed to solving a three-year-old mystery surrounding the death of almost 10 per cent of the endangered kākāpō population in New Zealand. Professor Travis Glare co-authored a paper in Science Direct which looked at how a single fungal black mould strain caused a fatal mass aspergillosis outbreak, allowing it to be traced back to its source. Senior technician Jenny Brookes processed the samples for the study.

In 2019, during a successful nesting season, the outbreak affected 21 individuals and led to the deaths of nine, leaving a population of only 211 kākāpō.

Aspergillosis is a respiratory disease caused by the inhalation of spores from fungi. The lung physiology of birds makes them susceptible and aspergillosis can affect otherwise healthy birds when spore loads are high. The study identified the strain may have been brought to the birds' five offshore sanctuary islands by humans through supplemental feeding, though it is also possible multiple variables combined to cause the disease. Using whole-genome sequencing data to identify the strain and understand the epidemic allowed the researchers to suggest procedures to detect and mitigate such events in the future.

Credit image: Plant and Food Research

Hopes to save an endangered native beetle through pheromone identification

Lincoln University spider expert Dr Cor Vink is part of a collaborative project aiming to identify the redback spider pheromone to save the native endangered Cromwell chafer beetle found in Otago.

Dr Vink is part of the Plant & Food Research-led project, in collaboration with Ngāi Tahu and the Department of Conservation, which was granted $999,999 by the Ministry of Business, Innovation and Employment Endeavour Fund in 2023. The venomous redback poses a threat to native fauna as well as humans. Any possible biological control would also harm the closely related native katipō spiders, so the team will attempt to recreate the pheromones to attract the male to a trap - a world first for pest management use.

Making a positive impact in Christchurch's red zone

Hundreds of volunteers from the University of Canterbury and Lincoln University came together to volunteer in Christchurch's red zone, weeding and mulching around 20,000 native trees planted the year before. The Rotary Forests of Peace and Remembrance project is a partnership between Rotary, Council and Conservation Volunteers New Zealand and local volunteers to create native ecosystems to help battle climate change.

SDG 16

Promote peaceful and inclusive societies for all and build effective, accountable and inclusive institutions at all levels

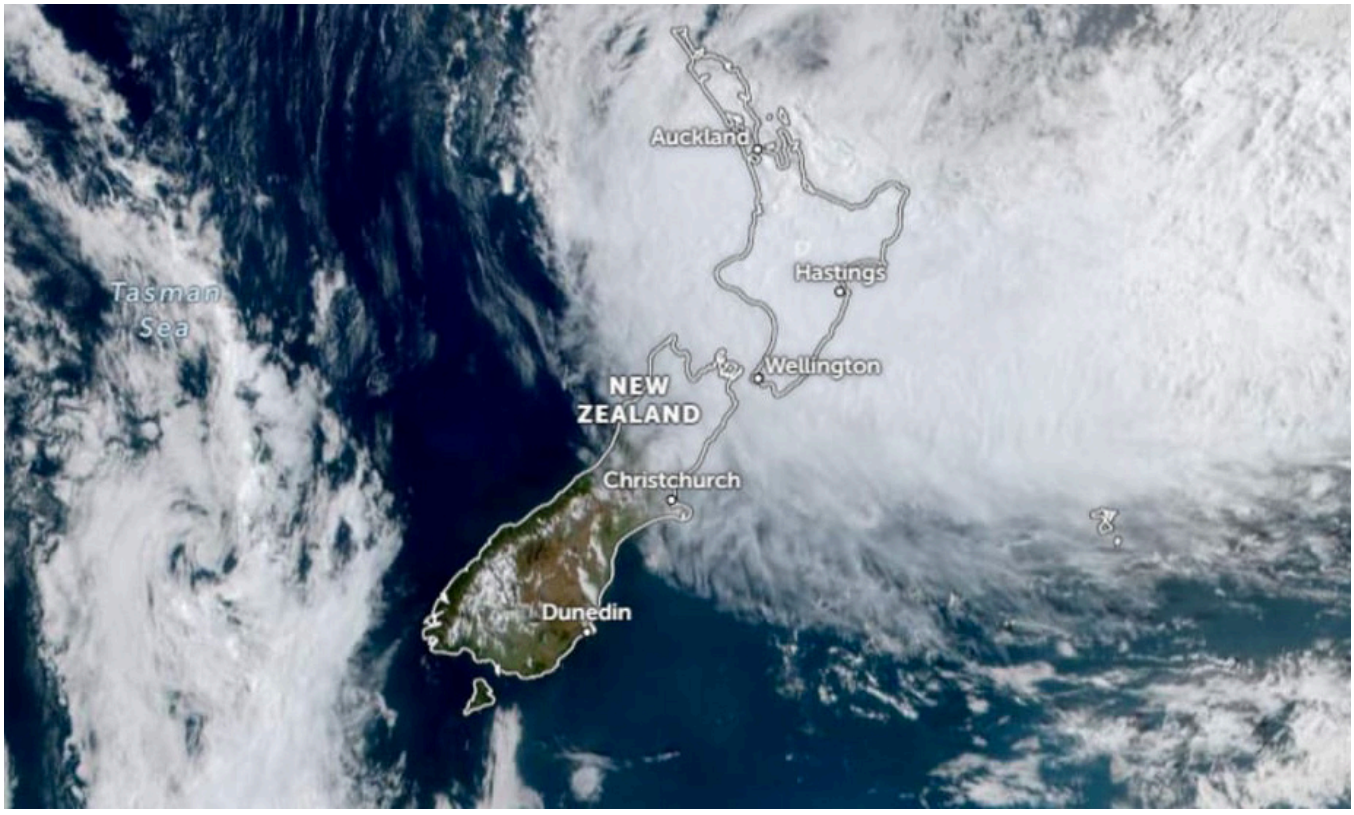
Working with government for a better future

Lincoln University's research and development subsidiary, Lincoln Agritech, GreenTech Team Leader Dr David Rankin spoke at the first 2023 Speakers Science Forum in Parliament on 21 February. These sessions are organised for Members of Parliament to attend research presentations on key issues for the country. The February forum focused on food security where Dr Rankin discussed major food security risks in New Zealand and how we can prevent or mitigate these issues to ensure a food-secure future. With food security already challenged by multiple major weather events in recent years, the impact of climate change on food production can be proactively mitigated by immediate climate action. He concluded that we need to further develop climate and risk models to inform national and regional adaptation plans and accelerate the reduction of greenhouse gas emissions.

Our atmosphere and climate 2023, the latest New Zealand report under the Environmental Reporting Act 2015, drew on the work of Lincoln University scientists alongside government data providers, mātauranga Māori and scientific literature. Authored by the Ministry for the Environment and Stats NZ, it highlights the pressures brought by a changing climate and the possible future outcomes. The report is designed to improve public awareness and understanding of these issues and support better environmental decision-making. Two Lincoln University research projects were cited as evidence that there is a more than 90% likelihood that New Zealand faces an increased risk of fire frequency and severity and that dairy farming is at increased risk from extreme weather events. A study of flooding in the lower South Island demonstrated the damage to dairy farmland and infrastructure and lost revenue from disruption to milk tanker access.

Reducing corruption and improving the welfare of migrant families

Corruption afflicts many low and middle-income countries that rely on remittances, that is, monies sent by migrants back to families in their home countries. These monies serve as an important source of income for many households. Although remittances can drive economic growth, raise living standards, and alleviate poverty, they may also exacerbate corruption. But this trade-off need not be made. Lincoln University researcher Dr. Puneet Vatsa, with Dr. Luis Gautier, published a study that showed that it is possible to harness the developmental potential of remittances while reducing corruption.



Advocate for sustainable land use recognised

Lincoln University recognises a member of the academic staff for their contribution as a critic and conscience of society yearly at its excellence awards. Nominated by staff and students, the award is presented when a judging panel considers an individual to have provided the public or government with an exceptional level of independent, expert commentary on national or global issues.

In 2023, Associate Professor Peter Almond was presented with the award. He has contributed significantly to Lincoln University's reputation and upheld the obligations of a critic and conscience of society through his advocacy for sustainable land use via the protection of high-quality soils, a vital resource under increasing threat from erosion, pollution and incompatible land use.

Associate Professor Almond's championing for a secure future for the quality soils of the Canterbury region includes working with national and local body government, environmental agencies and commissioners, other experts and community groups, and sometimes participation in legal action. He also provided expert opinion and public commentary on the impacts of Cyclone Gabrielle.

Matapaki Ka Tahi – communicating consent

Initiated by ACC, as part of their programme on reducing sexual harm, Ara Institute of Canterbury, Lincoln University, University of Canterbury and their respective student associations, collaboratively created and ran the Matapaki Ka Tahi campaign emphasising the importance of consent and how to initiate these conversations.

The campaign involved consultation with interested parties including Christchurch Police, Te Pūtahitanga o Te Waipounamu, Te Mana Ora | Community and Public Health and Christchurch City Council. The campaign formed a part of Lincoln University's wider sexual harm prevention programme and was launched before orientation week at the beginning of the university year.

A series of focus groups involving students were conducted to discover the best way of messaging the campaign with positive feedback received from students throughout the year sharing the messaging helped bring up consent conversations. Other materials in support of the campaign included a staff handbook, offering information and the procedures to follow should a student report they have experienced sexual harm.

SDG 17

Strengthen the means of implementation and revitalise the global partnership for sustainable development

Towering partnership with Nepal celebrated

In 2023, Lincoln University celebrated more than 50 years of Nepali students coming to study, with 60 students having completed a range of research-based qualifications. In many instances, the students later published findings in scholarly journals. As a result of this research, large areas of Nepalese conservation land have, or are currently, managed by Lincoln graduates.

Sir Edmund and Louise Hillary founded the Himalayan Trust in the 1960s to inspire New Zealanders to donate their time and money to support Nepal by establishing more than 40 schools, hospitals and medical clinics. Some of the earliest students from those schools went on to study at Lincoln. The Himalayan Trust opened its first school in Khumjung in 1961, and a student from that school, Mingma Norbu Sherpa, arrived at Lincoln in 1975. Completing a Diploma in Parks and Recreation in 1980, Mingma had a distinguished career in conservation work, including with WWF's Himalayan Programme and was the first Sherpa to serve as Warden of Sagarmatha/ Everest after Sir Edmund Hillary helped establish the park in 1976.

The collective body of scholarly research by Nepalese students at Lincoln University spanning more than 60 years is showcased in a 2023 publication: *A bibliographical review of research completed by Nepali students at Lincoln University, New Zealand (1956-2022)*. The publication demonstrates how the lives of these students have been shaped by their time at Lincoln and how their education and experience have enabled them to contribute to the future development of Nepal across land-based disciplines, including tourism, environmental management, economics and soil, plant, agricultural, horticultural, animal and social sciences.

To further deepen the ties between Lincoln University and Nepal, the Mingma Norbu Sherpa Memorial Scholarship was established. The scholarship is a partnership between Lincoln University, WWF and the Greater Himalayan Foundation and is offered to Nepali students committed to environmental protection and natural resource management in Nepal. Current Mingma Norbu Sherpa Memorial scholar, Roshni Gurung is studying for her Master of Applied Science in Environmental Management and contributed to the bibliography by creating a map which identifies the research locations of previous Lincoln University Nepali research students.

Taking a global approach to biosecurity to benefit all

Lincoln University's Professor Philip Hulme was one of the lead authors of the Assessment Report on Invasive Alien Species and their Control which was approved by representatives of the 143 member states of the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES). He is calling for a global approach to biosecurity as it is estimated by 2050 there will be at least 30% more invasive alien species worldwide. This approach would help deal with biosecurity threats across national borders that affect human, animal, plant and ecosystem health.

The report highlights the global nature of these biosecurity threats, the huge impacts invasive species have on food security, human health and the environment and the importance to policymakers worldwide. Professor Hulme, the only New Zealand researcher involved, said it was the most comprehensive global assessment of invasive alien species ever undertaken and took almost 100 authors working together over four years to produce.

Expanding international partnerships to support student growth and global engagement

A new Joint Institute with Huazhong Agricultural University in China was established in 2023. The Joint Institute of Huazhong Agricultural University (HZAU) and Lincoln University is located at HZAU in Wuhan, China. It offers four jointly awarded qualifications by both universities - the Master of Environmental Management, Bachelor of Science Conservation and Ecology, Bachelor of Viticulture and Oenology and Bachelor of Commerce (Horticulture). The joint institute extends beyond the University's existing joint-degree programmes, articulation agreements and student exchange programmes and emphasises Lincoln University's desire to expand its international partnerships and pathways to support student growth and global engagement.

The partnership provides a significant opportunity for Lincoln to collaborate with a top-tier institution. The total enrolment capacity is 1,000 students while there is a staff exchange component to foster the global exchange of knowledge and innovation in the land-based sectors.

Joining forces to drive agricultural innovation

A Memorandum of Understanding between Lincoln University and Ballance Agri-Nutrients (BAN) shows a commitment to advancing new and better farming and growing practices in New Zealand. Climate change has brought a need for rapid and effective solutions, especially in areas like greenhouse gas emissions, carbon farming, and carbon sequestration. By addressing these challenges collaboratively, Lincoln and BAN can contribute to the resilience and sustainability of New Zealand's primary industry and support industry aspirations such as the Fonterra Climate Roadmap.

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Find out more at www.lincoln.ac.nz